MECHANICAL Y SECTIONS SPECIFICATION

For

CITY COLLEGE PLYMOUTH
MARINE TECHNOLOGY CENTRE

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Y10 PIPELINES AND PIPEWORK

1010 PREFABRICATED PIPEWORK:
- Supply prefabricated pipework in accordance with relevant materials and workmanship clauses.

2010A HEAVY BLACK STEEL PIPES TO BS EN 10255:
- Material - Steel
- Standard - BS EN 10255
- Dimensions - Heavy. Random single lengths, 4m to 7m.
- Ends - Screwed to relevant parts of BS EN 10226, taper thread or plain.
- Finish - Varnished.

2010B MEDIUM BLACK STEEL PIPES TO BS EN 10255:
- Material - Steel
- Standard - BS EN 10255
- Dimensions - Medium. Random single lengths, 4m to 7m.
- Ends - Screwed to relevant parts of BS EN 10226, taper thread or plain.
- Finish - Varnished.

2010E HEAVY BLACK STEEL PIPES TO BS EN 10255 - GROOVED ENDS:
- Material - Steel
- Standard - BS EN 10255
- Dimensions - Heavy. Random single lengths, 4m to 7m.
- Ends - Grooved for mechanical joints.
- Finish - Unvarnished, varnished, painted.

2060A CARBON STEEL FITTINGS, BUTT WELDED TO BS EN 10253:
- Material
  - Carbon steel, grade S235.
- Standard - BS EN 10253-1.
- Size range - 25mm to 400mm.
- Dimensions - BS EN 10253-1.
- Ends - Bevelled.
- Finish - Varnished.

2060B CARBON STEEL FITTINGS, BUTT WELDED TO BS EN 10253:
- Material
  - Carbon steel, grade P235TR2 or P265TR2.
- Standard - BS EN 10253-2. Type B fittings.
- Size range - 25mm to 400mm.
- Dimensions - BS EN 10253-2.
- Ends - Bevelled.
- Finish - Varnished.

2070A MALLEABLE CAST IRON FITTINGS, SCREWED:
- Material - Cast iron to BS EN 1562.
- Standard - BS 143 & 1256 or BS EN 10242.
- Size range - 10mm to 164mm.
- Dimensions - BS 143 & 1256 or BS EN 10242.
- Ends - screwed to relevant parts of BS EN 10226
- Finish - Black

2080F PAINTED STEEL FITTINGS, GROOVED FOR MECHANICAL JOINTS:
- Material - Steel fittings to ASTM A-53.
- Standard - Manufacturer's.
- Size range - 20mm to 600mm.
- Ends - Grooved for mechanical joints.
- Finish - Painted.

2090 STEEL FITTINGS, SCREWED TO BS EN 10241:
- Material
- Standard - BS EN 10241.
- Size range - 6mm to 150mm.
- Dimensions - BS EN 10241.
- Ends - Screwed to relevant parts of BS EN 10226.
- Finish
  - Black or galvanized to suit pipework system.

2270A COPPER HALF HARD:
- Kitemarked.
- Material - copper.
- Standard - BS EN 1057, R250, (Class X).
- Dimensions - BS EN 1057 table 3.
- Ends - plain, grooved for mechanical joints; copper-tube dimensioned.
- Finish - uncoated.

2270B CHROMIUM PLATED COPPER, HALF HARD:
- Kitemarked.
- Material - Copper.
- Standard - BS EN 1057, R250, (Class X).
- Dimensions - BS EN 1057 table 3.
- Ends - Plain
- Finish - Chromium plated.

2310A CAPILLARY FITTINGS FOR COPPER TUBING, GENERAL POTABLE RANGE:
- Material - Copper or dezincifiable resistant copper alloy.
- Standard - BS EN 1254-1.
- Size range - 6mm to 67mm.
- Dimensions - BS EN 1254-1 table 2.
- Ends - Integral (lead-free) solder ring.
- Finish - Natural.

2320A TYPE A COMPRESSION FITTINGS FOR COPPER TUBING:
- Kitemarked.
- Material - Dezincifiable resistant copper alloy
- Standard - BS EN 1254-2, type A, non-manipulative.
- Size range - 6mm to 54mm.
- Dimensions - BS EN 1254-2, table 2 and 3.
- Ends - Socket.
- Finish - Natural.

2320B TYPE A COMPRESSION FITTINGS FOR CHROME PLATED COPPER TUBING:
- Kitemarked.
- Material - Dezincifiable resistant copper alloy and brass.
- Standard - BS EN 1254-2, type A, non - manipulative.
- Size range - 6mm to 54mm.
- Dimensions - BS EN 1254-2, table 2 and 3.
- Ends - Socket.
- Finish - Chrome plated.

2320C TYPE B COMPRESSION FITTINGS FOR COPPER TUBING:
- Kitemarked.
- Material - Dezincifiable resistant copper alloy and brass.
- Standard - BS EN 1254-2, type B manipulative.
- Size range - 6mm to 54mm.
- Dimensions - BS EN 1254-2, tables 2 and 3.

- Ends - Socket.
- Finish - Natural.

2322 CAPILLARY FITTINGS, SHORT, FOR BRAZING TO COPPER TUBING:
- Material - Dezincifiable resistant copper alloy.
- Standard - BS EN 1254-5
- Size range - BS EN 1254-5 - 67mm to 159mm.
- Dimensions - BS EN 1254-5, table 2.
- Ends - Plain.
- Finish -Natural.

2330A COPPER TO BS EN 12449:
- Material - Copper.
- Standard - BS EN 12449, seamless, round tubes.
- Dimensions - BS EN 12449.
- Ends - Plain or screwed.
- Finish - Uncoated.

2332A COPPER TO BS EN 12450:
- Material - Copper.
- Standard - BS EN 12450 seamless, round copper capillary tubes.
- Dimensions - BS EN 12450
- Ends - Plain or screwed.
- Finish - Uncoated.

2442 PLASTIC PIPING SYSTEMS TO BS EN 15014:
- Standard - BS EN 15014.
- Application - Buried and above ground systems for water (not potable) and other fluids under pressure.
- Performance characteristics for pipes, fittings and their joints.
- Performance characteristics - reaction to fire; external pressure strength; internal pressure strength; dimensional tolerance; tightness (air and water); durability; dangerous substances.

2480A UNPLASTICIZED PVC TO BS 4514:
- Material - Unplasticized PVC.
- Standard - BS 4514.
- Dimensions - BS 4514.
- Ends - Plain.
- Finish - Black, grey or white.

2490A UNPLASTICIZED PVC FITTINGS, SOLVENT WELDING TO BS 4514:
- Material - Unplasticized PVC.
- Standard - BS 4514, table 2.
- Size range - 82mm,110mm or 160mm.
- Dimensions - BS 4514 tables 3 and 5.
- Ends - Spigot/plain.
- Finish - Black, grey or white.

2495A PLASTICS PIPING SYSTEMS TO BS EN 1453-1:
- Plastics piping system with structured wall pipes for soil and waste discharge (low and high temperature) within the building structure.
- Material - Unplasticised polyvinyl chloride (PVC-U).
- Standard - BS EN 1453-1.
- Dimensions - Length - manufacturer's standard range. BS EN 1453-1 tables1, 2 and 3.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

2525A BURIED POLYETHYLENE PIPES FOR GASEOUS FUELS TO BS ISO 4437:
- PE Pipes, including any identification tapes.
- Material - Polyethylene (PE).
- Standard
  - BS ISO 4437-1
  - BS ISO 4437-2
  - BS ISO 4437-3
  - BS ISO 4437-5
- Dimensions
  - BS ISO 4437-1
  - BS ISO 4437-2
  - BS ISO 4437-3
  - BS ISO 4437-5
- Ends - Plain for butt fused joints.
- Finish - Black, yellow.

2525B BURIED POLYETHYLENE PIPES FOR GASEOUS FUELS TO BS ISO 4437:
- PE pipes with co-extruded layers on either or both the outside and/or inside.
- Material - Polyethylene (PE).
- Standard
  - BS ISO 4437-1
  - BS ISO 4437-2
  - BS ISO 4437-3
  - BS ISO 4437-5
- Dimensions
  - BS ISO 4437-1
  - BS ISO 4437-2
  - BS ISO 4437-3
  - BS ISO 4437-5
- Ends - Plain for butt fused joints.
- Finish - Black, yellow.

2525C BURIED POLYETHYLENE PIPES FOR GASEOUS FUELS TO BS ISO 4437:
- PE pipes with additional external thermoplastics layer.
- Material - Polyethylene (PE).
- Standard
  - BS ISO 4437-1
  - BS ISO 4437-2
  - BS ISO 4437-3
  - BS ISO 4437-5
- Dimensions
  - BS ISO 4437-1
  - BS ISO 4437-2
  - BS ISO 4437-3
  - BS ISO 4437-5
- Ends - Plain for butt fused joints.
- Finish - Black, yellow.

2528 POLYETHYLENE PIPES TO BS EN 1555:
- Material - Polyethylene.
- Standard - BS EN 1555-1, BS EN 1555-2 and BS EN 1555-5.
- Dimensions - BS EN 1555-2
  - Lengths - straight pipe 6m or 12m.
  - Lengths - coiled pipe multiples of 50m.
- Marking - BS EN 1555-2
- Ends - Plain.
- Finish

- Black
- Yellow
- Black with yellow identification stripes.

2550A POLYPROPYLENE FITTINGS, TO BS EN 1451-1:
- Material - Polypropylene.
- Standard - BS EN 1451-1.
- Size range - 32 to 50mm.
- Dimensions - BS EN 1451-1.
- Ends - Plain; or ring seal, multi-vane or compression sockets.
- Finish - Natural self colour.

2580A SOLID WALL PVC-U PIPING SYSTEMS - PIPES:
- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
- Material - Unplasticised polyvinyl chloride (PVC-U).
- Standard - PVC-U to BS EN 1329-1 and BS 4514 as appropriate to the application.
- Dimensions - Length - manufacturer's standard range. BS EN 1329-1 tables 1, 2, 3 and 4.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

2580F STRUCTURED-WALL PVC-U PIPING SYSTEMS - PIPES:
- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
- Material - Unplasticised polyvinyl chloride (PVC-U).
- Standard - Structure-wall PVC-U to BS EN 1453-1.
- Dimensions - manufacturer's standard range. BS EN 1453-1.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey.

2585A PVC-U PIPING SYSTEMS TO BS EN 1329-1 - FITTINGS:
- Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure.
- Material - Unplasticised polyvinyl chloride (PVC-U).
- Standard - PVC-U to BS EN 1329-1 and BS 4514 as appropriate to the application.
- Size range - 32mm to 315mm.
- Dimensions - BS EN 1329-1 tables 5-14.
- Ends - Plain; elastomeric ring seal socket and spigot; or socket and spigot for solvent cement.
- Finish - Grey, black, or white.

2665A POLYETHYLENE TO WIS 4-32-17:
- Material - Polyethylene.
- Standard - WIS 4-32-17.
- Dimensions - WIS 4-32-17 table 6.
- Lengths - straight pipe 6m, 12m or 18m; coils, 25m, 50m, 100m or 150m.
- Ends - Plain.
- Finish - Blue, black, black with brown stripes or black with green stripes.

2668A POLYETHYLENE TO BS EN 12201:
- Plastic piping system for water under pressure up to 20°C and 25bar.
- Material - Polyethylene.
- Standard - BS EN 12201-1, BS EN 12201-2, BS EN 12201-5.
- Dimensions - BS EN 12201-2, table 2.
- Marking - BS EN 12201-2, table 4.
- Lengths - No requirements, to be agreed between purchaser and manufacturer.
- Ends - Plain or sockets.
- Finish - Blue or black with blue stripes.

2706A PLASTICS FITTINGS TO BS 7291-2 AND BS 7291-3:
- Material - Polybutylene (PB) BS 7291-2 or crosslinked polyethylene (PE-X) BS 7291-3.
- Standard - BS 7291.Classification H unless otherwise indicated.
- Size range - BS 7291-2 and BS 7291-3;10mm - 35mm (Cu); BS ISO 11922-1, BS ISO 4065 or BS ISO 11414.
- Dimensions - BS 7291-2 (PB) or BS 7291-3 (PE-X)
- Ends - Plain; flanged or screwed to suit method of jointing.
- Finish - Natural.

3010A CIRCULAR FLANGES FOR PIPES, PN DESIGNATED - WELDED FLANGE:
- Material - BS EN 1092-1.
- Flange type - Weld neck flange or hubbed slip-on flange for welding.
- Flange facings - Raised face - type B.
- Bolting - In accordance with BS EN 1092-1.

3010B CIRCULAR FLANGES FOR PIPES, PN DESIGNATED - THREADED FLANGE:
- Material to BS EN 1092-1.
- Facings - Raised face type B.
- Bolting - in accordance with BS EN 1092-1.
- Threaded flanges - to relevant parts of BS EN 10226 parallel thread.

3020A JOINTING RINGS - NON-METALLIC FLAT GASKETS:
- Non-metallic flat gaskets for flanges to BS EN 1092-4.
- Standard - BS EN 1514-1
- Gasket type - Full face for type B.

3020B JOINTING RINGS - METALLIC GASKETS:
- Corrugated, flat or grooved metallic and filled metallic gaskets for flanges to BS EN 1092-4.
- Standard - BS EN 1514-4
- Gasket type - Corrugated metal.
- Gasket design - Self centring for type B.

3030A SCREWED JOINTS TO BS EN 10226:
- Use PTFE tape to BS 7786 or use hemp and jointing compound to BS 6956-5, or BS EN 751-2.

3030B SCREWED JOINTS TO BS EN 10226 WITH PTFE TAPE:
- Use PTFE tape to BS 7786.

3030C SCREWED JOINTS TO BS EN 10226 WITH CHEMICAL CLEANING:
- Use hemp and jointing compound to BS 6956-5 or BS EN 751-2, prior to chemical treatment and use PTFE tape to BS 7786 after chemical treatment.

3050A WELDED JOINTS, WELDING RODS FOR STEEL PIPES:
- Gas welding, BS EN 12536; electric arc welding BS 2971.

3070A CAPILLARY JOINTS FOR COPPER:
- Use materials as follows:
  - Fittings - BS EN 1254-1
  - Solder - BS EN ISO 9453
  - Flux - copper pipe - classification labelling and packaging to BS EN ISO 9454-1 and performance requirements to BS EN ISO 9454-2

3070B CAPILLARY JOINTS FOR POTABLE WATER:
- Use materials as follows:
  - Use WRAS approved lead-free fittings in accordance with BS EN 1254-1, on potable water systems
  - Solder - BS EN ISO 9453
  - Flux - copper pipe - classification, labelling and packaging to BS EN ISO 9454-1 and performance

requirements to BS EN ISO 9454-2

3080 JOINTING EQUIPMENT FOR MULTI-LAYER PIPE SYSTEM:
• Provide the Manufacturer's recommended compression tool for making connections in the multi-layer pipe system.

3095B JOINTING MATERIALS FOR PLASTICS PIPES TO BS 7291 - PUSHFIT:
• Plastics fittings to BS 7291.
  • Method of jointing to BS 5955-8
  • Mechanical joints - Pushfit.

3095C JOINTING MATERIALS FOR PLASTICS PIPES TO BS 7291 - SOLVENT CEMENT:
• Plastics fittings to BS 7291.
  • Method of jointing to BS 5955-8 - Solvent cement joints.

3095D JOINTING MATERIALS FOR PLASTICS PIPES TO BS 7291 - THERMAL FUSION:
• Plastics fittings to BS 7291.
  • Method of jointing to BS 5955-8 - Thermal fusion joints.

3190A WALL, FLOOR AND CEILING CHROMIUM PLATED MASKING PLATES:
• Material - Copper alloy, chromium plated.
• Type - Heavy, split on the diameter, close fitting to outside of pipe.
• Fixing - Chrome raised head fixing screws.

3200A PIPE RINGS AND CLIPS, STEEL PIPEWORK:
• Use suitable pipe, hangers, slider and roller type supports, taking into account the pipe load, material and pipe/insulation surface temperature.

4010 APPEARANCE:
• Arrange all exposed pipe runs to present neat appearance, parallel with other pipe or service runs and building structure, subject to gradients for draining or venting.
• Ensure all vertical pipes are plumb or follow building line.

4020 SPACING:
• Space pipe runs in relation to one another, other services runs and building structure, allow for specified thickness of thermal insulation and ensure adequate space for access to pipe joints, etc.
• The following are recommended as minimum clearances in spacing of pipe runs:-

Between	and	Clearance (mm)
Pipeline insulated or uninsulated	Wall Finish	25
	Ceiling Finish	50
	Soffit Floor Finish	150
Insulated Pipeline	Adjacent service runs	25
Uninsulated pipeline	Adjacent service runs	50
Adjacent pipelines	Both uninsulated	150
	One uninsulated	75
	Both insulated	25

4030 GRADIENTS:
• Install pipework with gradients to allow drainage and/or air release, and to the slopes where indicated.

4040A AIR BOTTLES:
• Provide a means of venting the pipe system at all high points.
• Provide a vertical extension from the pipe approximately 100mm long, at the bore of the pipe, with a copper extension pipe with a manual vent cock located in an easily accessible position.

4040B AUTOMATIC AIR VENTS:
- Provide a means of venting the pipe system at all high points.
- Provide an automatic air vent valve with a copper outlet pipe from the valve to a tundish in an adjacent drain line or to another suitable location.

4050 DRAIN REQUIREMENTS:
- Grade pipework to allow system to be drained. Provide a means of draining the system at all low points.

4060 EXPANSION AND CONTRACTION:
- Arrange supports and fixings to accommodate pipe movement caused by the thermal changes, generally allow the flexure at changes in direction. Allow for movement at branch connections.
- For water systems, using a grooved pipework system, the proprietary flexible couplings may be used to accommodate thermal growth, contraction and for the elimination of expansion loops. The type, quantity required, locations and installation/support details of flexible couplings proposed shall be in accordance with the manufacturer's written recommendations and show on the installation drawings. Where loops are required, use flexible couplings on the loop.

4070A PIPE FITTINGS, BENDS/SWEPT TEES:
- Use eccentric type reductions and enlargements on horizontal pipe runs to allow draining and venting, concentric on vertical pipes, with easy transition and an included angle not exceeding 30 degree. Do not use bushes, except at radiators and at fittings where required size is not of standard manufacture. Where required, use eccentric bushes to allow draining or venting; maximum aspect ratio not to exceed two pipe sizes; above this ratio use reducing fittings. Use square tees at venting and draining points. Square elbows are not acceptable. Use bends and swept tees where practical.

4070B PIPE FITTINGS, ELBOWS/SQUARE TEES:
- Use eccentric type reductions and enlargements on horizontal pipe runs to allow draining and venting, concentric on vertical pipes, with easy transition and an included angle not exceeding 30 degree. Do not use bushes, except at radiators and at fittings where required size is not of standard manufacture. Where required, use eccentric bushes to allow draining or venting; maximum aspect ratio not to exceed two pipe sizes; above this ratio use reducing fittings. Use square tees at venting and draining points. Square elbows are not acceptable. Use elbows and square tees.

4110 PIPES THROUGH NON FIRE RATED WALLS AND FLOORS:
- Enclose pipes passing through building elements, (walls, floors, partitions, etc.) concentrically within purpose made sleeves. Fit masking plates where visible pipes pass through building elements, including false ceilings of occupied rooms. Unless detailed elsewhere, carry insulation including vapour barrier where necessary through pipe sleeves.

4120A PIPE SLEEVES IN NON FIRE RATED WALLS AND FLOORS - INSULATION NOT CARRIED THROUGH:
- Where pipe insulation is not carried through pipe sleeve, cut sleeves from material same as pipe one or two sizes larger than pipe to allow clearance. Do not use sleeves as pipe supports.
- Install sleeves flush with building finish. In areas where floors are washed down install with a 100mm protrusion above floor finish and cap off end of sleeve.

4125 PIPES PASSING THROUGH FIRE BARRIERS:
- Where pipes pass through a fire rated wall or floor use one of the following methods
  - Proprietary sleeves
    - Install proprietary fire sleeves, tested to BS 476-20 and the principles of BS 467-21 or BS 476-22, or BS EN 1366-3 to meet the fire rating of the partition. In each case the thermal insulation and vapour sealing properties (where required) shall be maintained through the wall, floor or partition. The sleeves shall be
    - Mineral wool insulated fire sleeves comprising a combination of mineral wool and graphite intumescent or
    - A one piece stainless steel sleeve with an intumescent lining the full length and 3 bands of acoustic foam adhered to the bore of the sleeve. Where insulation is carried through the wall or

partition and vapour seal is required, oversized mineral wool shall be fitted to the pipework with an oversized proprietary sleeve fitted over the mineral wool.

- Ablative coated batt
  - All components and sealants / glue used must be tested to relevant parts of BS 476 or BS EN 1366-3, and be provided from a single manufacturer.
  - For plastic pipes, install a proprietary ablative coated batt in combination with a proprietary fire sleeve where the pipes pass through the batt. Ablative batt minimum density to be 180 kg/m^3 and have a test certificate to match the fire resistance of the wall or partition.
  - For metal pipes install proprietary fire rated insulation for 500mm either side of the batt. Standard - BS 3958-4

- Proprietary systems must be installed strictly in accordance with the manufacturers' recommendations.
- All products used, to have third party certification by a scheme accredited by UKAS.
- Support centres for services passing through penetration seals serving fire barriers to be the same as those covered by the test / assessment / certification evidence provided by the installer / manufacturer of the penetration seal.
- Install and inspect fire stopping systems in accordance with Building Regulations Approved Document B, ASFP Code of Practice TGD 17 and the general best practice guidance given in the ASFP On-site guide to installing fire-stopping.

4150A TEMPORARY PLUGS, CAPS AND FLANGES:

- Seal all open ends as installation proceeds by plugs, caps or blank flanges, to prevent ingress of foreign matter.
- Use plugs of metal, plastic or wood to suit pipework material.

In the event of such precautions not being taken, strip out pipework adjacent to open ends to demonstrate that fouling of bores has not occurred.

4160 FLANGED JOINTS GENERAL:

- Use number and diameters of bolts to standard. Fit bolts of length to give not less than one thread, or more than 3mm protrusion beyond nut when joint is pulled up.
- Fit washers under each nut.

4170 DISSIMILAR METALS:

- Take appropriate means to prevent galvanic action where dissimilar metals are connected together.

4180 PIPE RINGS AND CLIPS:

- Select type according to the application and material compatibility, give particular attention where pipes are subject to axial movement due to expansion or contraction.

4190 ANCHORS:

- Construct to resist axial stress transmitted by flexure of horizontal and vertical pipe runs or loading on vertical pipes assuming that unbalanced forces exist at all anchor points, even when these are situated in intermediate positions between two expansion loops or bellows. Use similar or compatible materials to the attached pipe.
- Provide and fix all associated backing plates, nuts, washers and bolts for attachment to or building into building structure; ensure structure is suitable for transmitted stress. Set out and line up anchors accurately in position. Inspect final grouting into building structure.

4200 SLIDE GUIDES:

- Direct movement of expansion and contraction from pipe anchor points towards loops, bellows or flexible inserts. Ensure that thrust is linear relative to the axis of pipe.
- Apply a friction reducing material between metal faces subjected to movement.

4205 PIPE SUPPORTS:

- Arrange supports and accessories for equipment, appliances or ancillary fitments in pipe runs, so that no undue strain is imposed upon pipes.
- Ensure that materials used for supports are compatible with pipeline materials.

4210 SUPPORT SYSTEM - WIRE ROPE:

- Provide wire rope support system. Confirm wire rope is suitable for supporting pipelines.

4220 SUPPORT SPACING:

- Space supports as tables.

Pipe Size (mm)	Maximum Support Spacing (m)					
Nominal	Steel Pipe (Insulated)		Copper or Light Gauge Stainless Steel Pipe (Insulated)		Iron Pipe	
	horizontal	vertical	horizontal	vertical	horizontal	vertical
Up to 15	1.8	2.4	1.2	1.8	-	-
20	2.4	3.0	1.2	1.8	-	-
25	2.4	3.0	1.5	2.4	-	-
32	2.4	3.0	1.8	3.0	-	-
40	2.4	3.7	1.8	3.0	-	-
50	2.4	3.7	1.8	3.0	1.8	1.8
65	3.0	4.6	2.4	3.7	-	-
80	3.0	4.6	2.4	3.7	2.7	2.7
100	3.0	4.6	2.4	3.7	2.7	2.7
125	3.7	5.5	3.0	3.7	-	-
150	4.5	5.5	3.7	3.7	3.7	3.7
200	6.0	8.5	-	-	3.7	3.7
250	6.5	9.0	-	-	4.5	5.4
300	7.0	10.0	-	-	8.0	10.0
350	10.0	12.0	-	-	-	-
400	10.5	12.6	-	-	-	-
450	11.0	13.2	-	-	-	-
500	12.0	14.4	-	-	-	-
600	14.0	16.8	-	-	-	-

Pipe OD	Maximum Support Spacing (m) PVC or ABS Pipe Contents up to 20°C	
	Horizontal	Vertical
15	0.8	1.2
20	0.8	1.2
25	0.9	1.3
32	1.0	1.5
40	1.1	1.6
50	1.3	1.9
80	1.6	2.4
100	1.9	2.8
150	2.1	3.0
200	2.4	3.6
250	2.6	3.9
300	2.8	4.2

- For grooved steel and copper pipe, no individual pipe length should be left unsupported.
- Vertical support spacing
  - Check total self-weight and pressure loading against manufacturer's recommendations when using mechanical joints or end load capable flexible couplings. Ensure adequate pipe support when using non-end load capable flexible couplings.
  - Space vertical support intervals for plastics pipe at not greater than twice horizontal intervals tabulated.
  - Space external vertical PE gas pipes in accordance with the current edition of IGEM/UP/2
- Space horizontal and vertical pliable corrugated stainless steel gas pipes in accordance with the

current edition of IGEM/UP/2.
- Where multiple pipe runs of differing bores are supported from a common point, use support spacing of pipe requiring closest spacing.
- Spacings given for PVC-U pipe to BS EN ISO 1452

4230A ISOLATION AND REGULATION:
- Provide valves, cocks and stop taps for isolation and/or regulation where indicated, and on:-
  - mains to isolate major sections of distribution;
  - The base of all risers and drops except in cases where one item of apparatus only is served which has its own local valve or stop tap;
  - Points of pipe connection of all items of apparatus and equipment except where the item could conveniently be isolated or regulated by valves provided for other adjacent items;
  - Draw-off fittings except where ranges of fittings are served by a common float, the isolator then being fitted with the float.

4240 MAINTENANCE AND RENEWAL:
- Arrange pipework, valves, drains, air vents, demountable joints, supports, etc., for convenient routine maintenance and renewals. Provide all runs with a regularly spaced pattern of demountable joints in the form of unions, flanges, etc., and also at items of equipment to facilitate disconnection.
- Locate valves, drains, flanges etc. in groups.

5010B WELDING GENERAL, CLASS 2:
- Use skilled craftsman in possession of a current Certificate of Competence appropriate to type and class of work, issued by an approved authority. Mark each weld to identify operative. Submit specimen welds, representative of joints and conditions of site welding, for each craftsman, test non-destructively, approximately 10% of butt weld joints and 5% of all other joints.
- Weld pipeline joints to BS 2971 and to BESA TR/5 Code of Practice: Welding of Carbon Steel Pipework, as appropriate.

5020 WELDED JOINTS, STEEL PIPES:
- Preparation, Making and Sealing.
  - Arc welding, conforming to BS 2971 appropriate to system temperature and pressure. Use arc welding process on piping greater than 100mm.

5030 PAINTING WELDED JOINTS, STEEL PIPES:
- Unless pipework is being prepared for galvanizing after manufacture, wire brush and paint all welds with red oxide paint when welds are complete.

5040 FLANGED JOINTS, STEEL PIPES:
- Welded Flanges
  - Weld neck and bore of 'slip on' flange.
  - Butt weld neck of welding neck flange.
- Screwed Flanges
  - Apply jointing materials. Screw on flange and expand tube into flange with roller expander where necessary.
- Preparation
  - Ensure that flange mating faces are parallel; flange peripheries are flush with each other; and bolt holes are correctly aligned.
- Making and Sealing
  - Insert jointing between flange mating faces. Pull up joint equally all round.

5050 SCREWED JOINTS, STEEL PIPES:
- Preparation
  - Ensure that plain ends are cut square. Reamer out bore at plain ends.
  - Screw plain ends, taper thread.
- Making and Sealing
  - Coat male pipe threads with jointing compound and hemp, or PTFE tape on small sizes. Immediately after applying coating, connect with female end of socket or fitting, and tighten ensuring that coating does not intrude into pipe. Leave joint clean.

5060 MECHANICAL JOINTS, GROOVED STEEL AND STAINLESS STEEL PIPES:

- Preparation
  - Ensure installers receive training from manufacturer on correct installation technique, and correct and safe use of pipe grooving tool by a factory trained manufacturer's representative. The grooving tool must be manufactured by the grooved coupling manufacturer. Ensure that cut ends are square, free of bumps, dents and score marks and that pipe outside diameter is within mechanical joint manufacturer's tolerances. Form groove in accordance with manufacturer's recommendations and to manufacturer's groove diameter tolerances. Ensure that the manufacturer supplies a grooved measuring tape to be able to check the groove is in tolerance. Manufacturer must provide certification to anyone grooving onsite or in a fabrication shop to show the correct training has been provided. Assemble joint in accordance with manufacturer's instructions.
- Making and Sealing
  - Ensure gasket material is suitable for service. For standard couplings thoroughly lubricate gasket, externally and internally, using manufacturer's recommended lubricant. Stretch gasket over one pipe end and bring pipe ends together. Slide gasket into central position over both pipe ends. Position joint half housings over gasket and insert bolts and nuts. Joints should not require any torque to show visual bolt pad to pad connection, if alternative joints are to be proposed that require torque this must be notified at the time of tender for approval. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.
- Earth continuity
  - Full earth continuity shall be achieved by both rigid and flexible couplings. If the manufacturer's coupling selected cannot achieve this, install proprietary earth continuity clips to ensure compliance with IET regulations at each joint.
- Installation-ready couplings
  - Do not dismantle the coupling. Lubricate inner sealing lips of gasket using manufacturer's recommended lubricant. Assemble the joint by inserting the grooved pipe ends into each opening of the coupling until the ends make contact with the gasket center leg. Tighten bolts to manufacturer's instructions. Check alignment of joint and pipework.

5070A ANCHORS, STEEL PIPES, U-BOLTS:

- Provide anchors constructed using mild steel over-straps or heavy U-bolts. Secure to channel section, adequately attached to or grouted into building structure; weld longitudinal edges of strap to pipe.

5070B ANCHORS, STEEL PIPES, SLIP-ON FLANGES:

- Provide anchors constructed by passing two slip-on flanges over pipe to anchor point. Bolt together through an interposed mild steel channel section attached to or grouted into building structure, and finally weld flanges to pipe.

5090 STEEL PIPEWORK PAINTING:

- Remove scale, rust or temporary protective coating by chipping, wire brushing or use of approved solvents and paint with one coat of red oxide primer, as work proceeds.

6030 COMPRESSION JOINTS, COPPER PIPES, LIGHT GAUGE:

- Preparation for fittings to BS EN 1254-2.
  - Type `A' fitting
    - Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool or fine sandpaper.
  - Type `B' fitting
    - Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool or fine sandpaper. Then comply with manufacturer's instructions.
- Making and Sealing - As manufacturer's instructions.

6040 CAPILLARY JOINTS, COPPER PIPES, LIGHT GAUGE:

- Preparation - Ensure that plain ends are cut square. Reamer out bore at plain ends to full bore size. Clean plain ends with fine steel wool.
- Making and sealing - Use specified flux ensuring no excess material used. Make joint in accordance with manufacturer's instructions. Clean off traces of flux when joint is completed.

6050 BRAZED JOINTS, COPPER/COPPER ALLOY PIPES:
- Preparation - Prepare for brazing in accordance with BS EN 14324. Use manufactured fittings not subject to dezincification and suitable for application.
- Making and Sealing - Use flame heat and make in accordance with BS EN 14324. Use silver brazing filler alloy suitable for application.

6060A ANCHORS, COPPER PIPES, SADDLE CLAMPS:
- Provide anchors constructed by fitting two flanges to copper female adapters in pipe run at anchor point. Bolt together through an interposed mild steel channel section attached to or grouted into building structure.

6060B ANCHORS, COPPER PIPES, SADDLE CLAMPS:
- Anchor pipework using saddle clamps to mild steel channel section attached to or built into building structure.

8005 THERMOPLASTIC PIPING SYSTEMS FOR SOIL AND WASTE DISCHARGE:
- Comply with recommendations in PD CEN/TR 13801 and general installation practice given in
  - BS EN 12056-1
  - BS EN 12056-2
  - BS EN 12056-3
  - BS EN 12056-4
  - BS EN 12056-5

8010 SOLVENT WELDED JOINTS, PVC PIPES:
- Use solvent welded joints generally, ring seal joints at expansion joints and elsewhere as necessary.
- Preparation - Ensure that plain ends are cut square. Reamer out bore at plain ends. Clean plain ends with solvent cleaner.
- Making and Sealing - In accordance with fitting manufacturer's instructions.

8020 FUSION JOINTS, POLYETHYLENE PIPES:
- Preparation - Square cut plain ends. Form pipe ends for socket type joints.
- Making and Sealing - In accordance with fitting manufacturer's instructions.
- Carry out butt fusion jointing of pipes and fittings in accordance with the manufacturer's instructions.

9030 PROTECTION OF UNDERGROUND PIPEWORK:
- Protect where indicated against corrosion by the application of a compatible anti-corrosive, non-cracking, non-hardening waterproof sealing tape.
- Apply, after cleaning pipework, by wrapping contrawise with two layers spirally around the pipe, ensuring a 50% minimum overlap.

9040A PROTECTION OF BURIED PIPES, UNMARKED:
- Provide earth cover as follows
- Water pipework
  - 900 mm minimum; 1200 mm maximum where practicable.
- Fuel oil and gas - 500 mm minimum.
- Under roadways provide minimum cover of 900 mm.

9040B PROTECTION OF BURIED PIPES, MARKED:
- Provide earth cover as follows
- Water pipework
  - 900 mm minimum; 1200 mm maximum where practicable.
- Fuel oil and gas - 500 mm minimum.
- Under roadways provide minimum cover of 900 mm.
- Provide a marker tape to identify buried pipe services as indicated.

9060A INSTALLATION OF THERMALLY INSULATED UNDERGROUND STEEL PIPELINES:
- Install pre-insulated bonded steel pipelines to BS EN 253, BS EN 448, BS EN 488 and BS EN 489 in accordance with manufacturer's instructions and BS EN 13941 or BS EN 15698-1 for twin pipe

systems.

BS APPENDIX
BS 476-3:2004
Fire tests on building materials and structures. Part 3 Classification and method of test for external fire exposure to roofs

BS 476-4:1970
Fire tests on building materials and structures. Part 4 Non-combustibility test for materials

BS 476-6:1989+A1:2009
Fire tests on building materials and structures. Part 6 Method of test for fire propagation for products

BS 476-7:1997
Fire tests on building materials and structures. Part 7 Method of test to determine the classification of the surface spread of flame of products

BS 476-10:2009
Fire tests on building materials and structures. Part 10 Guide to principles, selection, role and application of fire testing and their outputs

BS 476-11:1982
Fire tests on the building materials and structures. Part 11 Method for assessing the heat emission from building materials

BS 476-12:1991
Fire tests on building materials and structures. Part 12 Method of test for ignitability of products by direct flame impingement

BS 476-13:1987, ISO 5657:1986
Fire tests on building materials and structures. Part 13 Method of measuring the ignitability of products subjected to thermal irradiance

BS 476-20:1987
Fire tests on building materials and structures. Part 20 Method for determination of the fire resistance of elements of construction (general principles)

BS 476-20:1987
Fire tests on building materials and structures. Part 20 Method for determination of the fire resistance of elements of construction (general principles)

BS 476-21:1987
Fire tests on building materials and structures. Methods for determination of the fire resistance of loadbearing elements of construction

BS 476-22:1987
Fire tests on building materials and structures. Part 22 Method for determination of the fire resistance of non-loadbearing elements of construction

BS 476-22:1987
Fire tests on building materials and structures. Part 22 Method for determination of the fire resistance of non-loadbearing elements of construction

BS 476-24:1987, ISO 6944:1985
Fire tests on building materials and structures. Part 24 Method for determination of the fire resistance of ventilation ducts

BS 476-31.1:1983
Fire tests on building materials and structures. Part 31.1 Methods for measuring smoke penetration through doorsets and shutter assemblies. Method of measurement under ambient temperature

conditions

BS 476-32:1989
Fire tests on building materials and structures. Part 32 Guide to full scale fire tests within buildings

BS 476-33:1993, ISO 9705:1993
Fire tests on building materials and structures. Part 33 Full-scale room test for surface products

BS 2971:1991
Specification for class II arc welding of carbon steel pipework for carrying fluids

BS 3958-4:1982
Thermal insulating materials. Part 4 Bonded preformed man-made mineral fibre pipe sections

BS 4514:2001
Unplasticized PVC soil and ventilating pipes of 82.4mm minimum mean outside diameter, and fittings and accessories of 82.4mm and of other sizes. Specification

BS 5955-8:2001
Plastics pipework (thermoplastics materials). Part 8 Specification for the installation of thermoplastic pipes and associated fittings for use in domestic hot and cold services and heating systems in buildings

BS 6956-5:1992
Jointing materials and compounds. Part 5 Specification for jointing compounds for use with water, low pressure saturated steam, 1st family gases (excluding coal gas) and 2nd family gases

BS 7291-1:2010
Thermoplastics pipes and fitting systems for hot and cold water for domestic purposes and heating installations in buildings. Part 1 general requirements

BS 7291-2:2010
Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings. Part 2 specification for polybutylene (PB) pipes and associated fittings

BS 7291-2:2010
Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings. Part 2 specification for polybutylene (PB) pipes and associated fittings

BS 7291-3:2010
Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings. Part 3 specification for cross-linked polyethylene (PE-X) pipes and associated fittings

BS 7291-3:2010
Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings. Part 3 specification for cross-linked polyethylene (PE-X) pipes and associated fittings

BS 7786:2006
Specification for unsintered PTFE tapes for general use.

BS EN 253:2009+A2:2015
District heating pipes. Pre-insulated bonded pipe systems for directly buried hot water networks. Pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene

BS EN 448:2015
District heating pipes. Pre-insulated bonded pipe systems for directly buried hot water networks. Fitting assemblies of steel service pipes, polyurethane thermal insulation and outer casing of polyethylene

BS EN 488:2015
District heating pipes. Preinsulated bonded pipe systems for directly buried hot water networks. Steel valve assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene

BS EN 489:2009
District heating pipes. Pre-insulated bonded pipe systems for directly buried hot water networks. Joint assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene

BS EN 751-2:1997
Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water. Part 2 Non-hardening jointing compounds

BS EN 1057:2006+A1:2010
Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications

BS EN 1092-1:2018
Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 1 steel flanges

BS EN 1092-4:2002
Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 4 aluminium alloy flanges

BS EN 1254-1:1998
Copper and copper alloys. Plumbing fittings. Part 1 fittings with ends for capillary soldering or capillary brazing to copper tubes.

BS EN 1254-2:1998
Copper and copper alloys. Plumbing fittings. Part 2 fittings with compression ends for use with copper tubes

BS EN 1254-5:1998
Copper and copper alloys. Plumbing fittings. Part 5 Fittings with short ends for capillary brazing to copper tubes

BS EN 1329-1:2014+A1:2018
Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Unplasticized poly(vinyl chloride) (PVC-U). Specifications for pipes, fittings and the systems

BS EN 1366-3:2009
Fire resistance tests for service installations. Penetration seals

BS EN 1451-1:2017
Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure. Part 1 Polypropylene (PP). Specifications for pipes, fittings and the system

BS EN 1453-1:2017
Plastics piping systems with structured-wall pipes for soil and waste discharge (low and high temperature) inside buildings. Unplasticized poly (vinyl chloride) (PVC-U). Part 1 Specifications for pipes and the system

BS EN 1514-1:1997
Flanges and their joints. Dimensions of gaskets for PN-designated flanges. Part 1 Non-metallic flat gaskets with or without inserts

BS EN 1514-4:1997
Flanges and their joints. Dimensions of gaskets for PN-designated flanges. Part 4 Corrugated, flat or grooved metallic and filled metallic gaskets for use with steel flanges

BS EN 1555-1:2010
Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE). Part 1 General

BS EN 1555-2:2010
Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE). Part 2 Pipes.

BS EN 1555-3:2010+A1:2012
Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE). Part 3 Fittings.

BS EN 1555-4:2011
Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE). Part 4 Valves

BS EN 1555-5:2010
Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE). Part 5 Fitness for purpose of the system.

BS EN 10226-1:2004
Pipe threads where pressure tight joints are made on the threads. Taper external threads and parallel internal threads. Part 1 dimensions, tolerances and designation

BS EN 10226-2:2005
Pipe threads where pressure tight joints are made on the threads. Taper external threads and taper internal threads. Dimensions, tolerances and designation

BS EN 10226-3:2005
Pipes threads where pressure-tight joints are made on the threads. Verification by means of limit gauges

BS EN 10241:2000
Steel threaded pipe fittings

BS EN 10242:1995
Threaded pipe fittings in malleable cast iron

BS EN 10253-1:1999
Butt-welding pipe fittings. Part 1 Wrought carbon steel for general use and without specific inspection requirements

BS EN 10253-2:2007
Butt-welding pipe fittings. Part 2 Non alloy and ferritic alloy steels with specific inspection requirements

BS EN 10253-3:2008
Butt-welding pipe fittings. Wrought austenitic and austenitic-ferritic (duplex) stainless steels without specific inspection requirements

BS EN 10253-4:2008
Butt-welding pipe fittings. Wrought austenitic and austenitic-ferritic (duplex) stainless steels with specific inspection requirements

BS EN 10255:2004
Non-alloy steel tubes suitable for welding and threading. Technical delivery conditions

BS EN 12056-1:2000
Gravity drainage systems inside buildings. Part 1 General and performance requirements

BS EN 12056-2:2000
Gravity drainage systems inside buildings. Part 2 Sanitary pipework, layout and calculation

BS EN 12056-3:2000
Gravity drainage systems inside buildings. Part 3 Roof drainage, layout and calculation

BS EN 12056-4:2000
Gravity drainage systems inside buildings. Part 4 Wastewater lifting plants. Layout and calculation

BS EN 12056-5:2000
Gravity drainage systems inside buildings. Part 5 Installation and testing, instructions for operation, maintenance and use

BS EN 12201-1:2011
Plastic piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Part 1 General

BS EN 12201-2:2011+A1:2013
Plastic piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Part 2 Pipes

BS EN 12201-3:2011+A1:2012
Plastic piping systems for water supply, and for drainage and sewerage under pressure. Part 3 Polyethylene (PE) Fittings

BS EN 12201-4:2012
Plastic piping systems for water supply, and for drainage and sewerage under pressure. Part 4 Polyethylene (PE). Valves

BS EN 12201-5:2011
Plastic piping systems for water supply, and for drainage and sewerage under pressure. Part 5 Polyethylene (PE). Fitness for purpose of the system

BS EN 12449:2016
Copper and copper alloys. Seamless, round tubes for general purposes

BS EN 12450:2012 :
Copper and copper alloys. Seamless, round copper capillary tubes

BS EN 12536:2000
Welding consumables. Rods for gas welding of non alloy and creep-resisting steels. Classification

BS EN 13941:2009+A1:2010
Design and installation of pre-insulated bonded pipe systems for district heating

BS EN 14324:2004
Brazing. Guidance on the application of brazed joints

BS EN 15014:2007
Plastics piping systems. Buried and above ground systems for water and other fluids under pressure. Performance characteristics for pipes, fittings and their joints

BS EN 15698-1:2009
District heating pipes. Pre-insulated bonded twin pipe systems for directly buried hot water networks. Part 1 Twin pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene

BS EN ISO 1452-1:2009
Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U). Part 1 General

BS EN ISO 1452-2:2009

Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U). Part 2 Pipes

BS EN ISO 1452-3:2010
Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U). Part 3 Fittings

BS EN ISO 1452-4:2009
Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U). Part 4 Valves

BS EN ISO 1452-5:2009
Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized poly(vinyl chloride) (PVC U). Part 5 Fitness for purpose of the system

BS EN ISO 9453:2014
Soft solder alloys. Chemical compositions and forms

BS EN ISO 9454-1:2016
Soft soldering fluxes. Classification and requirements. Classification, labelling and packaging

BS EN ISO 9454-2:2001
Soft soldering fluxes. Classification and requirements. Performance requirements

BS ISO 4065:2018
Thermoplastics pipes. Universal wall thickness table

BS ISO 4437-1:2014
Plastic piping systems for the supply of gaseous fuels. Polyethylene (PE). General

BS ISO 4437-2:2014
Plastic piping systems for the supply of gaseous fuels. Polyethylene (PE). Pipes

BS ISO 4437-3:2014
Plastic piping systems for the supply of gaseous fuels. Polyethylene (PE). Fittings

BS ISO 4437-4:2015
Plastics piping systems for the supply of gaseous fuels. Polyethylene (PE). Valves

BS ISO 4437-5:2014
Plastic piping systems for the supply of gaseous fuels. Polyethylene (PE). Fitness for purpose of the system

BS ISO 11414:2009
Plastic pipes and fittings. Preparation of polyethylene (PE) pipe/pipe or pipe/fitting test piece assemblies by butt fusion

BS ISO 11922-1:2018
Thermoplastics pipes for the conveyance of fluids. Dimensions and tolerances. Part 1 Metric series

Y11 PIPELINE ANCILLARIES

2015A STOP VALVES TO BS EN 1213 FOR POTABLE WATER SUPPLIES - COMPRESSION ENDS FOR COPPER:
- Pattern - Straight.
- Material - copper alloy.
- Flow rate class - VA (straight and angle pattern stopvalves).
- End connections - Compression to BS EN 1254-2.

2015C STOP VALVES TO BS EN 1213 FOR POTABLE WATER SUPPLIES - CAPILLARY:
- Pattern - Straight.
- Material - copper alloy.
- Flow rate class VA (straight and angle pattern stopvalves).
- End connections - Capillary to BS EN 1254-1.

2020A THREADED ENDS GATE VALVES TO BS EN 12288:
- Series - B.
- Gate valve type - Solid or split wedge.
- Ends - Threaded to BS EN ISO 228-1 or ISO 7-1.
- Stem - Inside screw non-rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.

2020B COMPRESSION ENDS GATE VALVES TO BS EN 12288:
- Series - B.
- Gate valve type - Solid or split wedge.
- Ends - Compression to BS EN 1254-2.
- Stem - Inside screw non-rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.

2020C FLANGED ENDS GATE VALVES TO BS EN 12288:
- Series - B.
- Gate valve type - Solid or split wedge.
- Ends - Flanged to BS EN 1092-3.
- Stem - Inside screw non-rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.

2020D LOOSE NUT/UNION ENDS GATE VALVES TO BS EN 12288:
- Series B.
- Gate valve type - Solid or split wedge.
- Ends - Loose nut/union end.
- Stem - Inside screw non-rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.

2030A FLANGED GATE VALVES TO BS EN 1171:
- Valve type - Solid or split wedge.
- Seat - Metal.
- Ends - Flanged to BS EN 1092-2.
- Body and bonnet material - Grey cast iron.
- Trim category - Copper alloy faced.
- Operation - Handwheel.

2040A THREADED END GLOBE VALVES TO BS 5154:
- Series - B.
- Pattern - Straight.
- Ends - Threaded to relevant parts of BS EN 10226.

- Stem - Inside screw rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.
- Options - Non-metallic renewable seat/disk rings.

2040B FLANGED GLOBE VALVES TO BS 5154:
- Series - B.
- Pattern - Straight.
- Ends - Flanged to BS EN 1092-3.
- Stem - Inside screw rising stem.
- Trim material - Manufacturer's standard.
- Operation - Handwheel.
- Options - Non-metallic renewable seat/disk rings.

2050A FLANGED GLOBE VALVES TO BS EN 13789:
- Pattern - Straight.
- Stem - Rising stem outside screw.
- Ends - Flanged to BS EN 1092-2.
- Material - Grey cast iron.

2070A FLANGED STOP VALVES - GATE TYPE TO BS EN 1984:
- Pattern - Full bore or reduced bore.
- Materials - Cast steel body and materials to suit fluid and operating conditions.
- Ends - Flanged.
- Operation - Handwheel.

2070D THREADED STOP VALVES - GATE TYPE TO BS EN 1984:
- Pattern - Full bore or reduced bore.
- Materials - Cast steel body and materials to suit fluid and operating conditions.
- Ends - Threaded to relevant parts of BS EN 10226
- Operation - Handwheel.

2080A THREADED END BALL TYPE VALVES - SCREW DRIVER/KEY OPERATED:
- Materials - bronze or DZR copper alloy body.
- Ends - threaded to relevant parts of BS EN 10226.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - screw driver operated or key operated.

2080B COMPRESSION END BALL TYPE VALVES - SCREW DRIVER/KEY OPERATED:
- Materials - bronze or DZR copper alloy body.
- Ends - compression fittings to BS EN 1254-2.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - screw driver operated or key operated.

2080C THREADED END BALL TYPE VALVES - LEVER OPERATED:
- Materials - bronze or DZR copper alloy body.
- Ends - threaded to relevant parts of BS EN 10226.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - lever operated.

2080D COMPRESSION END BALL TYPE VALVES - LEVER OPERATED:
- Materials - bronze or DZR copper alloy body.
- Ends - compression fittings to BS EN 1254-2.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.

- Operation - lever operated.

2080E THREADED END BALL TYPE VALVES - LOCKSHIELD:
- Materials - bronze or DZR copper alloy body.
- Ends - threaded to relevant parts of BS EN 10226.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - lockshield.

2080F COMPRESSION BALL TYPE VALVES - LOCKSHIELD:
- Materials - bronze or DZR copper alloy body.
- Ends - compression fittings to BS EN 1254-2.
- Chrome or nickel plated DZR sphere with full bore flow aperture. PTFE seats and stem seals. Anti-blowout stem.
- Operation - lockshield.

2085A SCREWED END SERVICING VALVES - HANDWHEEL OPERATED:
- Materials - copper alloy body.
- Ends - screwed to BS EN 1254-2.
- Operation - handwheel operated.

2085B COMPRESSION END SERVICING VALVES - HANDWHEEL OPERATED:
- Materials - copper alloy body.
- Ends - compression fittings to BS EN 1254-2.
- Operation - handwheel operated.

2085C CAPILLARY END SERVICING VALVES - HANDWHEEL OPERATED:
- Materials - copper alloy body.
- Ends - capillary ends to BS EN 1254-1.
- Operation - handwheel operated.

2085D SCREWED END SERVICING VALVES - LEVER OPERATED:
- Materials - copper alloy body.
- Ends - screwed to BS EN 1254-2.
- Operation - lever operated.

2085E COMPRESSION END SERVICING VALVES - LEVER OPERATED:
- Materials - copper alloy body.
- Ends - compression fittings to BS 864 and BS EN 1254-2.
- Operation - lever operated.

2085F CAPILLARY END SERVICING VALVES - LEVER OPERATED:
- Materials - copper alloy body.
- Ends - capillary ends to BS EN 1254-1.
- Operation - lever operated.

2085G SCREWED END SERVICING VALVES - SCREW DRIVER OPERATED:
- Materials - copper alloy body.
- Ends - screwed to BS 864 and BS EN 1254-2.
- Operation - screw driver operated.

2085H COMPRESSION END SERVICING VALVES - SCREW DRIVER OPERATED:
- Materials - copper alloy body.
- Ends - compression fittings to BS EN 1254-2.
- Operation - screw driver operated.

2085I CAPILLARY END SERVICING VALVES - SCREW DRIVER OPERATED:
- Materials - copper alloy body.

- Ends - capillary ends to BS EN 1254-1.
- Operation - screw driver operated.

2090A LEVER OPERATED BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:
- Construction - provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092.
- Provide lever and gear operated valves with long body neck for lagging clearance.
- Seat - bonded.
- Materials - ductile iron body; stainless steel shaft; aluminium bronze or stainless steel disc to suit application; EPDM seat.
- Operation - lever and graduated notch plate.

2090B GEAR OPERATED BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:
- Construction - provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092.
- Provide lever and gear operated valves with long body neck for lagging clearance.
- Seat - bonded.
- Materials - ductile iron body; stainless steel shaft; aluminium bronze or stainless steel disc to suit application; EPDM seat.
- Operation - gear operated.

2110A STOP VALVES - KEY OPERATED SLUICE TYPE A TO BS 5163-1 AND BS 5163-2:
- Valve type - A
- Seat - Resilient or metal seated.
- Stem seal - Stuffing box and gland; injector packing foil; or toroidal sealing rings (O-rings).
- Operation - T key.
- Materials - Manufacturer's standard and WRAS approved.
- Options - Stem cap.

2210A LEVER OPERATED REGULATING BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:
- Construction - Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092-2.
- Provide lever and gear operated valves with long body neck for lagging clearance.
- Seat - Bonded seat.
- Materials - Cast iron body; stainless steel shaft; aluminium bronze disc; EPDM seat.
- Operation - Infinitely variable setting with travel stops and indicator, lever operation.

2210B GEAR OPERATED REGULATING BUTTERFLY VALVES TO BS EN 593 BETWEEN FLANGES:
- Construction - Provide controlled elastomer compression on flange faces; semi-lugged wafer type design, for installation between flanged pipework connections, body to suit BS EN 1092-2.
- Provide lever and gear operated valves with long body neck for lagging clearance.
- Seat - Bonded seat.
- Materials - Cast iron body; stainless steel shaft; aluminium bronze disc; EPDM seat.
- Operation - Infinitely variable setting with travel stops and indicator, gear operation.

2220A THREADED END DOUBLE REGULATING VALVES TO BS 7350, COPPER ALLOY:
- BS 7350, section 3.1.
- Ends - Threaded to relevant parts of BS EN 10226.
- Material - Bronze or DZR copper alloy to BS 5154.
- Series B; oblique or Y pattern; inside screw non-rising stem; manufacturer's standard trim material.
- Options - Provide drain plug facility; independent means for positive isolation on pressure tapping or adapter; and test and manufacturer's certificates as indicated.

2220B FLANGED DOUBLE REGULATING VALVES TO BS 7350, COPPER ALLOY:
- BS 7350, section 3.1.
- Ends - Flanged to BS EN 1092-2.

• Material - Bronze or DZR copper alloy to BS 5154.
• Series B; oblique or Y pattern; inside screw non-rising stem; manufacturer's standard trim material.
• Options - Provide drain plug facility; independent means for positive isolation on pressure tapping or adapter; and test and manufacturer's certificates as indicated.

2220C FLANGED DOUBLE REGULATING VALVES TO BS 7350, CAST IRON:
• BS 7350, section 3.1.
• Ends - Flanged to BS EN 1092-2.
• Material - Cast iron to BS EN 13789.
• Oblique or Y pattern; copper alloy, nickel alloy or resilient valve face; rising stem outside screw or non-rising stem inside screw; manufacturer's standard materials.
• Options - Provide drain plug facility; independent means for positive isolation on pressure tapping or adapter; and test and manufacturer's certificates as indicated.

2230A THREADED ENDS FLOW MEASUREMENT DEVICES TO BS 7350, COPPER ALLOY:
• BS 7350, section 3.2 - type 3
• A fixed orifice either integral with or as a fixed orifice fitting close coupled to a double regulating globe valve.
• Ends - Threaded to relevant parts of BS EN 10226
• Material - Double regulating globe valve, bronze or DZR copper alloy to BS 7350 table 6.
• Options - Independent means for positive isolation on pressure tapping or adapter.

2230B FLANGED ENDS FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 3, COPPER ALLOY:
• BS 7350, section 3.2 - type 3
• A fixed orifice either integral with or as a fixed orifice fitting close coupled to a double regulating globe valve.
• Ends - Flanged to BS EN 1092-3.
• Material - Double regulating globe valve, bronze or DZR copper alloy to BS 7350 table 6.
• Options - Independent means for positive isolation on pressure tapping or adapter.

2230C FLANGED FLOW MEASUREMENT DEVICE TO BS 7350 CAST IRON, TYPE 3:
• BS 7350, section 3.2 - type 3
• A fixed orifice either integral with or as a fixed orifice fitting close coupled to a double regulating globe valve.
• Ends - Flanged to BS EN 1092-2.
• Material - Double regulating globe valve to BS EN 13789 and close coupled fixed orifice fitting to BS 7350, table 6.
• Options - Independent means for positive isolation on pressure tapping or adapter.

2230E THREADED ENDS FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 4, COPPER ALLOY:
• BS 7350, section 3.2 - type 4, variable orifice valve.
• Ends - Threaded to relevant parts of BS EN 10226
• Material - Variable orifice, double regulating globe valve, bronze or DZR copper alloy to BS EN 12288 and BS 5154 series B.
• Options - Independent means for positive isolation on pressure tapping or adapter.

2230F FLANGED FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 4, COPPER ALLOY:
• BS 7350, section 3.2 - type 4, variable orifice valve.
• Ends - Flanged to BS EN 1092-3.
• Material - Variable orifice, double regulating globe valve, bronze or DZR copper alloy to BS EN 12288 and BS 5154 series B.
• Options - Independent means for positive isolation on pressure tapping or adapter.

2230G FLOW MEASUREMENT DEVICES TO BS 7350 TYPE 4, CAST IRON:
• BS 7350, section 3.2 - type 4, variable orifice valve.
• Ends - Flanged to BS EN 1092-2.
• Material - Variable orifice, double regulating globe valve, cast iron to BS EN 13789.

• Options - Independent means for positive isolation on pressure tapping or adapter.

2260A RADIATOR VALVES TO BS 2767 (TYPE 4):
• Material - Bronze or brass copper alloy body.
• Pattern - Angle or straight to suit application.
• Straight - Threaded to relevant parts of BS EN 10226 or compression to BS EN 1254-2 to suit pipework as indicated.
• Angle - Threaded to relevant parts of BS EN 10226 with one end internal and other end external with union nut and tail pipe; or compression joint to BS EN 1254-2 one end and other end externally threaded to relevant parts of BS EN 10226 with union nut and tail pipe to suit pipework as indicated.
• Options - Fit wheel valves on flow connections to radiators, and other heat emitters, without thermostatic radiator valves. Fit lockshield valves on return connections.

2270A THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.1:
• Material to A.1.
• Pattern - Straight or angle pattern to suit application.
• Dimensions - Table A.1 series D.
• Thermostatic valve type - Integral sensor unless otherwise indicated.

2270B THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.2:
• Material to Annex A.
• Pattern - Straight or angle pattern to suit application.
• Dimensions - Table A.2 series F.
• Thermostatic valve type - Integral sensor unless otherwise indicated.

2270C THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.3:
• Material to Annex A.
• Pattern - Straight or angle pattern to suit application.
• Dimensions - Table A.3 series S.
• Thermostatic valve type - Integral sensor unless otherwise indicated.

2270D THERMOSTATIC RADIATOR VALVES TO BS EN 215 TABLE A.4:
• Material to Annex A.
• Pattern - Straight or angle pattern to suit application.
• Dimensions - Table A.4 series GB.
• Thermostatic valve type - Integral sensor unless otherwise indicated.

2280A FLOAT OPERATED VALVES TO BS 1212-1, COPPER FLOAT:
• Piston type float operated valve to BS 1212-1.
• Connection - Side or bottom entry to suit application.
• Float - Copper to BS 1968.

2280B FLOAT OPERATED VALVES TO BS 1212-1, PLASTIC FLOAT:
• Piston type float operated valve to BS 1212-1.
• Connection - Side or bottom entry to suit application.
• Float - Plastic to BS 2456.

2290A THREADED END FLOAT OPERATED VALVES, BALANCED EQUILIBRIUM:
• WRAS approved.
• Bronze or DZR copper alloy body.
• Inlet - Threaded to relevant parts of BS EN 10226
• Spindle and head effectively guided and arranged with stops to engage with valve body and prevent over travel. Linkage fulcrum adjustable relative to vertical plane, securely locked to body tapping when set.
• Screwed plug from access cover.
• Float and lever arm.
• Spun copper float, halves brazed or welded together, with centre sleeve connecting to lever arm. For feed and expansion application use long arm type arranged to close when tank contains 150mm

depth.

2315A OPEN/CLOSE CONTROL BALL VALVES:
- Valve - Open/Close valve.
- Rotary Actuator - Open/close.
- Material - Nickel-plated brass; stainless steel ball; PTFE seal; stainless steel spindle; EPDM spindle seal.
- Connections - Threaded to relevant parts of BS EN 10226.
- Ancillaries - Lever for manual operation.

2315B TWO WAY CONTROL BALL VALVES:
- Valve - Two way control valve.
- Rotary Actuator - Modulating.
- Material - Nickel-plated brass; stainless steel ball; PTFE seal; stainless steel spindle; EPDM spindle seal.
- Connections - Threaded to BS EN 10226
- Ancillaries - Lever for manual operation.

2315C THREE WAY CONTROL BALL VALVES:
- Valve - Three way control valve.
- Rotary Actuator - Modulating.
- Material - Nickel-plated brass; stainless steel ball; PTFE seal; stainless steel spindle; EPDM spindle seal.
- Connections - Threaded to relevant parts of BS EN 10226
- Ancillaries - Lever for manual operation.

2320A THREADED ENDS SWING CHECK VALVES TO BS 5154:
- Series B; horizontal pattern.
- Ends - Threaded to relevant parts of BS EN 10226
- Trim material - Manufacturer's standard.

2320B FLANGED SWING CHECK VALVES TO BS 5154:
- Series B; horizontal pattern.
- Ends - Flanged to BS EN 1092-3.
- Trim material - Manufacturer's standard.

2330A FLANGED SWING CHECK VALVES:
- Standard
- BS EN 16767
- Check valve type as defined in BS EN 736-1 - Swing.
- Body type - Flanged.
- Ends - Flanged to BS EN 1092-2.
- Orientation of pipework - Horizontal or vertical.

2330B WAFER BODY SWING CHECK VALVES:
- Standard
- BS EN 16767
- Check valve type as defined in BS EN 736-1 - Swing.
- Body type - Wafer.
- Orientation of pipework - Horizontal or vertical.

2330C FLANGED LIFT CHECK VALVES:
- Standard
  - BS EN 16767.
- Check valve type as defined in BS EN 736-1 - lift.
- Body type - flanged.
- Ends - flanged to BS EN 1092-2.
- Orientation of pipework - horizontal or vertical.

2330D WAFER BODY LIFT CHECK VALVES:
- Standard
- BS EN 16767
- Check valve type as defined in BS EN 736-1
- Check valve type to BS EN 736-1 - Lift.
- Body type - Wafer.
- Orientation of pipework - Horizontal or vertical.

2340A FLANGED SWING CHECK VALVES:
- Standard
- BS EN 16767
- Wafer pattern design suitable for installation between flanged pipework, body to suit BS EN 1092-2.
- Disc - Double disc.
- Type - Light spring type.
- Seat - Bonded.
- Materials - Cast iron body; bronze disc; EPDM seat.

2385A COMBINED CHECK AND ANTI-VACUUM DEVICE TO PREVENT CONTAMINATION OF WATER BY BACKFLOW TO BS EN 14451:
- Standard - BS EN 14451 combined check and anti-vacuum valves.
- WRAS approval.
- Ends - Compression connections to BS EN 1254-2.

2390A COMBINED CHECK AND ANTI-VACUUM TYPE ANTI BACK SYPHONAGE VALVES:
- Bronze or DZR copper alloy body assembly with compression connections to BS EN 1254-2.
- Pattern - In-line pattern.
- Components - Stainless steel domed air inlet. Non-return valve with plastic body, rubber actuator and stainless steel to plastic seal. WRAS approval.

2430A SAFETY VALVES, COPPER ALLOY, SINGLE SPRING:
- Material - bronze or DZR copper alloy body.
- Standard - BS EN ISO 4126-1, BS EN ISO 4126-7.
- Ends - threaded to relevant parts of BS EN 10226
- Spring type - single spring loaded, high lift type.

2430B SAFETY VALVES, COPPER ALLOY, DOUBLE SPRING:
- Material - bronze or DZR copper alloy body.
- Standard - BS EN ISO 4126-1, BS EN ISO 4126-7.
- Ends - threaded to relevant parts of BS EN 10226
- Spring type - double spring loaded, high lift type.

2430C SAFETY VALVES, CAST IRON, SINGLE SPRING:
- Material - cast iron body.
- Standard - BS EN ISO 4126-1, BS EN ISO 4126-7.
- Ends - flanged to BS EN 1092-2.
- Spring type - single spring loaded, high lift type.

2430D SAFETY VALVES, CAST IRON, DOUBLE SPRING:
- Material - cast iron body.
- Standard - BS EN ISO 4126-1, BS EN ISO 4126-7.
- Ends - flanged to BS EN 1092-2.
- Spring type - double spring loaded, high lift type.

2440A DRAIN COCKS, THROUGHWAY GLAND COCK:
- Bronze body threaded male to relevant parts of BS EN 10226
- Tapered plug with square shank for loose lever; bolted gland; strap and blank cap screwed on hand tight.

- Outlet to accept hose union.

2450 DRAIN COCKS - SCREWDOWN TO BS 2879, TYPE 1:
- Bronze body threaded male to relevant parts of BS EN 10226
- Screw down plug with square shank for loose lever.
- Serrated outlet to accept hosepipe, fixed or union pattern. Lockshield to accept key.

2460 DRAIN COCKS - BALL TYPE:
- Bronze or DZR copper alloy body; chrome-plated DZR ball; PTFE seats and stem seals; blow-out proof stem; strap and blank cap screwed on hand tight; serrated outlet to accept hose pipe. Lockshield key operated.

2490 VENT COCKS - THREE WAY GLAND COCK TYPE:
- Bronze body threaded to relevant parts of BS EN 10226; tapered plug with square shank for loose lever; plug position indicator; port markings to indicate inlet, vent, waste; bolted gland.
- Port configuration, T port.

2500A THREE WAY PLUG VALVE VENT COCKS - WRENCH OPERATED:
- Cast iron body, plug and bottom cover. PTFE thrust washer.
- Ends - Flanged to BS EN 1092-2.
- T port configuration. Wrench operation.

2500B THREE WAY PLUG VALVE VENT COCKS - GEAR OPERATED:
- Cast iron body, plug and bottom cover. PTFE thrust washer.
- Ends - Flanged to BS EN 1092-2.
- T port configuration. Gear operation.

2510A AUTOMATIC AIR VENTS, FLOAT TYPE:
- Construction - Bronze or DZR copper alloy body with threaded inlet to relevant parts of BS EN 10226. Solid polypropylene float and air release valve. Ensure valve is self closing.
- Operating Conditions - Maximum temperature 130°C. Maximum pressure 10 bar.
- Options - Provide connection for piping away released air and integral non-return valve where indicated.

2515A MICROBUBBLE TEMPERATURE DIFFERENTIAL DEAERATORS:
- Construction - Vertical mild steel housing incorporating internal spiral wound copper mesh system.
- Provide automatic air release mechanism.
- Ends - Line size with flanges to BS EN 1092-1, PN 16.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

2520A LTHW PRESSURE DIFFERENTIAL DEAERATORS:
- Unit - Provide a self circulating unit connected to the system by two 15mm connections at least 500mm apart.
- Isolation - Provide valves to isolate the vessel from the main system.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

2521A CENTRIFUGAL AIR SEPARATORS:
- Construction - Vertical steel housing with offset inlet and outlet ports to remove bubbles via centrifugal force. Provide automatic air release mechanism.
- Ends - Line size with flanges to BS EN 1092-1, PN 16.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

2522A GRAVITATION DIRT SEPARATORS:
- Construction - Vertical mild steel housing with internal reservoir, sludge pipe, perforation plate and automatic air release mechanism.
- Ends - Line size with flanges to BS EN 1092-1, PN 16.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

2524A MICROBUBBLE AIR AND DIRT SEPARATORS:
- Construction - Vertical steel housing with internal large surface area mechanism to remove microbubbles via coalescence effect. Fitted with dirt drain at its lowest point for removing dirt that sinks, and fitted with a dirt drain valve on the side of the housing for removing dirt that floats on the water.
- Provide automatic air release mechanism.
- Ends - Line size with flanges to BS EN 1092-1, PN 16.
- Operating conditions - Maximum temperature 110°C, maximum pressure 10 bar.

2610A STEEL EXPANSION LOOPS:
- Provide expansion loop in material and finish of associated pipeline. Size to limit stress set up in material of pipe wall to 69 MPa.
- Forge bend from a single length of pipe or join by welding fittings if expansion loops are too large to manufacture in one piece.
- Where indicated, galvanize after manufacture.
- Where scheduled or detailed in the particular specification provide expansion loops installed with grooved flexible mechanical joints and elbows. The joint manufacturer shall undertake calculations for sizing of the expansion loops. Installation to be strictly in accordance with the manufacturer's instructions.

2620 EXPANSION LOOPS - COPPER:
- Provide expansion loop in material and finish of associated pipeline. Size to limit total stress set up in material of pipe wall to less than 51.5 MPa.
- Forge bend from a single length of pipe.

2630A THREADED END EXPANSION COMPENSATORS, AXIAL BELLOWS:
- Ends - Threaded to relevant parts of BS EN 10226
- Bellows - Stainless steel, multi ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.
- Design, manufacture and install metal bellows expansion joints in accordance with BS EN 14917.

2630B FLANGED EXPANSION COMPENSATORS, AXIAL BELLOWS:
- Ends - Flanged to BS EN 1092-1.
- Bellows - Stainless steel, multi-ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation
- Design, manufacture and install metal bellows expansion joints in accordance with BS EN 14917.

2630D THREADED ENDS EXPANSION COMPENSATORS, ARTICULATED BELLOWS:
- Ends - Threaded to relevant parts of BS EN 10226.
- Bellows - Stainless steel, multi-ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.
- Design, manufacture and install metal bellows expansion joints in accordance with BS EN 14917.

2630E FLANGED EXPANSION COMPENSATORS, ARTICULATED BELLOWS:
- Ends - Flanged to BS EN 1092-1.
- Bellows - Stainless steel, multi-ply or single-ply construction fitted with stainless steel inner sleeves.
- Operation - Supply expansion joints capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.
- Design, manufacture and install metal bellows expansion joints in accordance with BS EN 14917.

2640A THREADED END HOSE COMPENSATORS:
- Supply convoluted stainless steel hose with stainless steel braiding. Fully welded construction.

- Ends - Threaded ends to relevant parts of BS EN 10226
- Operation - Supply hose compensators capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.

2640B FLANGED HOSE COMPENSATORS:
- Supply convoluted stainless steel hose with stainless steel braiding. Fully welded construction.
- Ends - Flanged to BS EN 1092-1.
- Operation - Supply hose compensators capable of not less than 2000 complete reversals of movement at the given working conditions; and of withstanding a pressure test of 1.5 times the design pressure without deformation.

2650A FLANGED EPDM RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 100°C:
- Material - EPDM rubber with wire reinforced cuffs.
- Steel reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Flanges to BS EN 1092-1 that can swivel and are removable.
- Operation - Ensure flexible connections have a design life of 120 months at 100°C. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2650B THREADED END EPDM RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 100°C:
- Material - EPDM rubber with wire reinforced cuffs.
- Steel reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Threaded to relevant parts of BS EN 10226 with one union end.
- Operation - Ensure flexible connections have a design life of 120 months at 100°C. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2650D FLANGED EPDM RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 70°C:
- Material - EPDM rubber with wire reinforced cuffs.
- Synthetic fibre reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Flanges to BS EN 1092-1 that can swivel and are removable.
- Operation - Ensure flexible connections have a design life of 120 months at 100°C. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2650E THREADED END EPDM RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 70°C:
- Material - EPDM rubber with wire reinforced cuffs.
- Synthetic fibre reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Threaded to relevant parts of BS EN 10226 with one union end.
- Operation - Ensure flexible connections have a design life of 120 months at 100°C. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2650F FLANGED FLEXIBLE CHLOROBUTYL RUBBER CONNECTIONS UP TO 10 BAR AND 100°C:
- Material - Multi-ply reinforced chlorobutyl rubber with wire reinforced cuffs. Synthetic fibre or steel

reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Flanges to BS EN 1092-1 that can swivel and are removable.
- Operation - Ensure flexible connections have a design life of 120 months at given conditions. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2650G THREADED END CHLOROBUTYL RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 100°C:
- Material - Multi-ply reinforced chlorobutyl rubber with wire reinforced cuffs. Synthetic fibre or steel reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Threaded to relevant parts of BS EN 10226 with one union end.
- Operation - Ensure flexible connections have a design life of 120 months at given conditions. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2650H FLANGED CHLOROBUTYL RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 60°C:
- Material - Multi-ply reinforced chlorobutyl rubber with wire reinforced cuffs. Synthetic fibre reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Flanges to BS EN 1092-1 that can swivel and are removable.
- Operation - Ensure flexible connections have a design life of 120 months at given conditions. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2650I THREADED END CHLOROBUTYL RUBBER FLEXIBLE CONNECTIONS UP TO 10 BAR AND 60°C:
- Material - Multi-ply reinforced chlorobutyl rubber with wire reinforced cuffs. Synthetic fibre reinforcement within the body.
- Marking - Mould date of manufacture on bellows.
- Show manufacturer and type.
- Ends - Threaded to relevant parts of BS EN 10226 with one union end.
- Operation - Ensure flexible connections have a design life of 120 months at given conditions. Provide tie bars with rubber top hat washers where working pressure exceeds 4 bar. Supply threaded tie bars with adjustable length. Ensure flexible connections are tied when the plant is on vibration isolation mountings.

2660A TERMINAL UNIT CONNECTIONS FOR HEATING SERVICES - STAINLESS STEEL:
- Material - Stainless steel convoluted hose with stainless steel overbraiding. Carbon steel, stainless steel or copper tube end connections. Fully welded construction.
- Operation - Ensure hose length is sufficient to prevent the minimum hose bend radius from being exceeded during installation and commissioning.
- Working pressure 15 - 20 bar and temperature 95°C.

2660B TERMINAL UNIT CONNECTIONS WITH QUICK RELEASE COUPLINGS FOR HEATING SERVICES - STAINLESS STEEL:
- Material - Stainless steel convoluted hose with stainless steel overbraiding. Carbon steel, stainless steel or copper tube end connections. Fully welded construction.
- Operation - Ensure hose length is sufficient to prevent the minimum hose bend radius from being exceeded during installation and commissioning. Working pressure 15 - 20 bar and temperature 95°C.
- Options - Supply quick release couplings with screwed ends.
- Materials - Male and female nickel plated brass halves each with shut-off valve with rubber seat.

Locking mechanism of stainless steel balls and stainless steel internal valve springs.

2670A TEST PLUGS, SELF SEALING:
- Provide DZR copper alloy self sealing test plugs for measurement of temperature and pressure, complete with captive cap for sealing when not in use. Ensure test plugs are suitable for system operating temperature and pressure.
- Provide one thermometer and pressure gauge for each range of conditions, for use with test plugs.

2670B TEST PLUGS, VALVE CONTROLLED:
- Provide DZR copper alloy self valve controlled test plugs for measurement of temperature and pressure, complete with captive cap for sealing when not in use. Ensure test plugs are suitable for system operating temperature and pressure.
- Provide one thermometer and pressure gauge for each range of conditions, for use with test plugs.

2680A THREADED PIPELINE STRAINERS, BRONZE:
- Material - Bronze to BS EN 1982.
- Ends - Threaded to relevant parts of BS EN 10226.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
  - 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
  - 65mm and over nominal size, within range 1.5 - 1.8mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to relevant parts of BS EN 10226.

2680B FLANGED PIPELINE STRAINERS, BRONZE:
- Material - Bronze to BS EN 1982.
- Ends - Flanged to BS EN 1092-3.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
  - 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
  - 65mm and over nominal size, within range 1.5 - 1.8mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to relevant parts of BS EN 10226.

2680C COMPRESSION PIPELINE STRAINERS, BRONZE:
- Material - Bronze to BS EN 1982.
- Ends - Compression fittings to BS EN 1254-2.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
  - 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
  - 65mm and over nominal size, within range 1.5 - 1.8mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to relevant parts of BS EN 10226

2680D PIPELINE STRAINERS, CAST IRON:
- Material - Cast iron.
- Ends - Flanged to BS EN 1092-2.
- Pattern - Y pattern body.
- Screen free area - Not less than 250% of pipe bore.
- Screen perforations
  - 15 to 50mm nominal size, within range 0.7 - 0.9 mm diameter.
  - 65mm and over nominal size, within range 1.5 - 1.8mm diameter.
- Internal to external flow through screen. Provide plugged connections for drain, air vent and differential pressure monitoring, threaded to relevant parts of BS EN 10226

2680G PIPELINE SUCTION GUIDE/STRAINERS:
- Body material - cast iron or ductile iron for water services to 110°C
- Ends - flanged to PN16 or PN25 to suit system maximum working pressure.
- Stainless steel strainer and fine mesh (start-up) strainer.
- Unit to be complete with flow stabilising vanes to allow connection direct to pump suction.
- Unit to be complete with removable stainless steel fine mesh sleeve start-up pre-filter.
- Provide plugged connections for drain, air vent and differential pressure monitoring.
- Installation to be strictly in accordance with the manufacturer's instructions.

2690A TUNDISHES, COPPER:
- Provide tundishes located adjacent to equipment, as indicated.
- Use 3mm minimum thickness copper sheet. Form sheet into a tapered reducing cone with a minor diameter to suit drain line.
- Major diameter nominally 50 mm larger than minor diameter, tapering at approximately 30°.

2690B TUNDISHES, MILD STEEL, GALVANIZED:
- Provide tundishes located adjacent to equipment, as indicated.
- Use mild steel sheet; galvanize after manufacture.
- Form sheet into a tapered reducing cone with a minor diameter to suit drain line.
- Major diameter nominally 50 mm larger than minor diameter, tapering at approximately 30°.

2700A GAUGES, GENERAL:
- Use dial type gauges of robust construction, enclosed in dust tight metal cases. Retain dial glass with bezels screwed to case. Finish with chromium plating.
- Use white dial scales indelibly and clearly marked with black lettering to indicate measured values. Select scale ranges which indicate `Normal' when pointer is vertical or central on scale.

2700C GAUGES, 150MM DIAMETER, DIRECT MOUNTING:
- Dial case - 150mm diameter, heavy pattern finished in black stove enamel, for direct connection to instrument.
- Mount gauges with dial face in vertical plane and support casing by connection to instrument.

2710A TEMPERATURE GAUGES, GENERAL:
- Mercury in steel type, mounted direct in pocket.
- Use temperature gauges with pocket and provided with gland attachment on thermometer stem.
- Use separable type pockets, threaded 15/19mm BSP and manufactured from stainless steel.
- Screw pockets into tapped bosses or stools set in pipelines or vessels. Fill pockets with oil to ensure contact with thermometer bulb.
- Provide gauges with dial graduation in °C marked on alogarithmic scale. Ensure pointer movement is clockwise for increase in temperature.
- Provide sensing elements for air and gas systems, where indicated, and fix to provide airtight joints.
- Provide with metal shielding around sensing element to prevent effects of local radiation from equipment.

2710B TEMPERATURE GAUGES, MERCURY IN STEEL:
- Provide mercury in steel temperature gauge, mounted direct in pocket.

2710C TEMPERATURE GAUGES, VAPOUR PRESSURE TO BS EN 13190 FOR DIRECT MOUNTING:
- Vapour pressure type to BS EN 13190, mounted direct in pocket, with horizontal or vertical stem as appropriate.

2720 PRESSURE AND ALTITUDE GAUGES:
- Use vapour pressure type gauges to BS EN 837-1. Connect to pipeline systems via matched gauge cocks and cock connectors.
- Ensure dial graduation is from zero to between 1.5 and 3.0 times normal working pressure. Graduate in bar (gauge) on gauges reading head or working pressure, or in Pascals where pressure differences across plant items are to be established. Where fitted on boilers and pressure vessels, clearly mark with operating and maximum permissible working heads in accordance BS 759. Elsewhere provide

gauges with normal working pressure. Ensure dial movement is clockwise for an increasing in head.
- Fit syphons on steam systems.
- Provide flexible piping where gauge is subject to noticeable vibration.
- Fit gauge cocks preceding all connections to altitude and pressure gauges. Copper alloy, tapered ground plug, with ebonite lever. Unless flanged joints are required, screw inlet ends female and Fit-outlet ends with union connections allowing removal of gauges.

3010A LOOSE ITEMS, KEYS FOR SPINDLE SHANK VALVES:
Provide tee handled short shank keys suitable for each size of valve spindle shank.

3010B LOOSE ITEMS, FOR DRAIN COCKS:
- Provide lever pattern keys suitable for each drain cock and loose hose unions for drain cocks.

4010 INSTALLATION:
- Install pipeline ancillaries in accordance with manufacturer's recommendations and BS 6683.

4020 LOCATION:
- Install valves, cocks, traps, strainers, test plugs, tundishes and other ancillary equipment in positions indicated.

4025 LOCATION OF THERMOSTATIC RADIATOR VALVES:
- Install thermostatic radiator valves in an area which reflects the space temperature. Ensure that they are not behind curtains or enclosed in heating or radiator panels.

4030 POSITIONING OF COMPONENTS:
- Locate flow and pressure measurement valves to ensure manufacturer's recommended straight length of pipe upstream and downstream of valve is provided.

4040 POSITIONING OF DOUBLE REGULATING VARIABLE ORIFICE VALVE:
- Install double regulating variable orifice valve to ensure equivalent of 10 diameters of straight pipe upstream and 5 diameters downstream of double regulating valve.

4050A POSITIONING OF CONTROL COMPONENTS:
- Install pipeline control components in accordance with manufacturer's instructions and in positions indicated.
- Insulation - Where control components are incorporated in insulated pipelines provide details of insulation method proposed, for approval.
- Supports - Arrange supports for control components to ensure no strain is imposed on components.
- Access - Arrange control components to ensure adequate access for operation and maintenance.

4070 VALVE STUFFING BOXES:
- Adjust glands of all stuffing boxes at normal plant operating temperature and pressure in accordance with manufacturer's instructions. Ensure that valve action is not impaired by over tightening.

4080A DISCHARGE CONNECTIONS, SAFETY VALVES:
- Fit pipework connections, where indicated, to provide discharge connection to Safety and Relief valves terminating at a safe discharge point.

4080B DISCHARGE CONNECTIONS, VENT COCKS:
- Fit pipework connections, where indicated, to provide discharge connection to vent cocks terminating 150mm above floor level.

4080D DISCHARGE CONNECTIONS, AUTOMATIC AIR VENTS:
- Fit pipework connections, where indicated, to provide discharge pipe to automatic air vents terminating over a suitable gully or drain line in a visible location.

4090 EXPANSION DEVICES:
- Where expansion and contraction cannot be accommodated by selected route, provide pipework loops, as indicated. Limit total stress set up in material of pipe wall, taking into account components

due to internal pressure, tension and bending to less than 69 MPa for steel pipelines and less than 51.5 MPa for copper pipe lines.
- Where location does not permit sufficient flexibility, provide proprietary devices, as indicated.

4100 EXPANSION COMPENSATORS INSTALLATION:
- Provide anchors and guides to contain all movement and resist maximum loads imposed. Install expansion compensators strictly in accordance with manufacturer's instructions.
- Select and install metallic bellows expansion joints, test/inspect the systems after installation of the expansion joints and 1st full movement and provide certification in accordance with BS 6129-1.

4110 FLEXIBLE CONNECTIONS INSTALLATION:
- Fit rubber bellows as close to source of vibration as practicable. Ensure the pipe at other end of bellows is a fixed point. Install flexible connections strictly in accordance with manufacturer's instructions.
- Ensure flexible connections are tied when the plant is on vibration isolation mountings.

BS APPENDIX

BS 759-1:1984
Valves, gauges and other safety fittings for application to boilers and to piping installations for and in connection with boilers. Part 1 Specification for valves, mountings and fittings

BS 864-5:1990
Capillary and compression tube fittings of copper and copper alloy. Part 5 Specification for compression fittings for polyethylene pipes with outside diameters to BS 5556.

BS 1212-1:1990
Float operated valves. Part 1 Specification for piston type float valves (copper alloy body) (excluding floats)

BS 1968:1953
Specification for floats for ballvalves (copper)

BS 2456:1990
Specification for floats (plastics) for float operated valves for cold water services

BS 2767:1991
Specification for manually operated copper alloy valves for radiators

BS 2879:1980
Specification for draining taps (screw-down pattern)

BS 5154:1991
Specification for copper alloy globe, globe stop and check, check and gate valves.
Partially replaced by BS EN 12288

BS 5163-1:2004
Valves for waterworks purposes. Part 1 Predominantly key-operated cast iron gate valves. Code of practice

BS 5163-2:2004
Valves for waterworks purposes. Part 2 Stem caps for use on isolating valves and associated water control apparatus. Specification

BS 6129-1:1981
Code of practice for the selection and application of bellows expansion joints for use in pressure systems. Metallic bellows expansion joints

BS 6683:1985
Guide to installation and use of valves

BS 7350:1990
Specification for double regulating globe valves and flow measurement devices for heating and chilled water systems

BS EN 215-1:1991
Thermostatic radiator valves. Part 1 Requirements and test methods

BS EN 215:2004
Thermostatic radiator valves. Requirements and test methods

BS EN 593:2017
Industrial valves. Metallic butterfly valves for general purposes.

BS EN 736-1:2018
Valves. Terminology. Definition of types of valves

BS EN 837-1:1998
Pressure gauges. Part 1 Bourdon tube pressure gauges. Dimensions, metrology, requirements and testing

BS EN 1092-1:2018
Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 1 steel flanges

BS EN 1092-1:2018
Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 1 steel flanges

BS EN 1092-2:1997
Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 2 cast iron flanges

BS EN 1092-2:1997
Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 2 cast iron flanges

BS EN 1092-3:2003
Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 3 copper alloy flanges

BS EN 1092-3:2003
Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 3 copper alloy flanges

BS EN 1092-4:2002
Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 4 aluminium alloy flanges

BS EN 1171:2015
Industrial valves. Cast iron gate valves

BS EN 1213:2000
Building valves. Copper alloy stopvalves for potable water supply in buildings. Tests and requirements

BS EN 1254-1:1998
Copper and copper alloys. Plumbing fittings. Part 1 fittings with ends for capillary soldering or capillary brazing to copper tubes.

BS EN 1254-2:1998

Copper and copper alloys. Plumbing fittings. Part 2 fittings with compression ends for use with copper tubes

BS EN 1982:2017
Copper and copper alloys. Ingots and castings

BS EN 1984:2010
Industrial valves. Steel gate valves

BS EN 10226-1:2004
Pipe threads where pressure tight joints are made on the threads. Taper external threads and parallel internal threads. Part 1 dimensions, tolerances and designation

BS EN 10226-2:2005
Pipe threads where pressure tight joints are made on the threads. Taper external threads and taper internal threads. Dimensions, tolerances and designation

BS EN 10226-3:2005
Pipes threads where pressure-tight joints are made on the threads. Verification by means of limit gauges

BS EN 12288:2010
Industrial valves. Copper alloy gate valves.

BS EN 13190:2001
Thermal insulation products for buildings. Factory made products of phenolic foam (PF). Specification

BS EN 13709:2010
Industrial valves. Steel globe and globe stop and check valves

BS EN 13789:2010
Industrial valves. Cast iron globe valves

BS EN 14451:2005
Devices to prevent pollution by backflow of potable water. In-line anti-vacuum valves DN 8 to DN 80. Family D, type A

BS EN 14917:2009+A1:2012
Metal bellows expansion joints for pressure applications

BS EN 16767:2016
Industrial valves. Steel and cast iron check valves

BS EN ISO 228-1:2003
Pipe threads where pressure-tight joints are not made on the threads. Part 1 Dimensions, tolerances and designation

BS EN ISO 4126-1:2013+A1:2016
Safety devices for protection against excessive pressure. Part 1 Safety valves

BS EN ISO 4126-7:2013+A1:2016
Safety devices for protection against excessive pressure. Common data

ISO 7-1:1994
Pipe threads where pressure-tight joints are made on the threads. Part 1 Dimensions, tolerances and designation

Y20 PUMPS

1010 PUMPS:
- Provide pumps manufactured and tested in accordance with appropriate British Standard.
- With regard to safety requirements, comply with BS EN 809 and BS EN 60335-2-51 where applicable.
- Twin headed pumps to be supplied with a matching blanking plate to enable the pump to be operated with a single head fitted during maintenance or replacement of standby head/impeller.
- All pumps for floor mounting to be supplied with proprietary support foot.

1020 PUMP SELECTION AND EFFICIENCY:
- Select pump at or near most efficient part of performance curve for duty required.
- Whenever possible select single stage glanded centrifugal pumps to achieve pump efficiency in the 'optimum efficiency' area (after correcting for pump head) of the figures in the European Guide to Pump Efficiency for Single Stage Centrifugal Pumps as published by Europump 2003.
- Do not select pumps on flat part of performance curve in the anticipated range of the system when used in variable volume applications.
- Comply with EU Regulation 547/2012 on ecodesign requirements of glanded centrifugal water pumps. Minimum Efficiency Index (MEI) to be as scheduled. Pump efficiency tests shall be carried out in accordance with BS EN 16480.
- Comply with EC Regulation 641/2009 and the amendment EU Regulation 622/2012 for glandless circulators. Energy Efficiency Index (EEI) to be as scheduled.

1030 SAFETY GUARDS:
- Fit safety guards around revolving parts on close coupled and belt drive pumps.

1040 PUMP TESTING:
- Ensure pumps comply with BS EN ISO 5198 and BS EN ISO 9906 as appropriate.

2010D CENTRIFUGAL PUMP - DIRECT DRIVE IN-LINE:
- Configuration
  - Direct driven unit with pump body incorporating inlet and outlet connections in line, to allow pump to be mounted in pipework.
- Standards
  - BS EN ISO 9908
  - BS EN 12756
- Casing
  - Provide casing with drain connection fitted with plug.
  - Provide threaded connections in accordance with relevant parts of BS EN 10226 for drains, vents, water jackets, cooling lines, etc.
  - Provide pump with split casing to allow access to the impeller for service and maintenance.
- Impeller
  - Ensure impellers are accurately machined and finished smooth, free from blowholes and other defects and designed to be in dynamic balance at all speeds.
  - Provide open or semi-open type impellers for removal of sludge or other foreign material to prevent clogging.
  - Fix impellers to shafts to ensure that they remain firm if direction of rotation is reversed.
  - Indicate direction of rotation on pump casing.
- Shaft
  - Ensure shaft is of adequate diameter to withstand all imposed loading and has a critical speed when assembled with its impeller at least 10% above normal operating speed.
- Material
  - Casing - Cast iron to BS EN 1561.
  - Impeller - Manufacturer's standard.
  - Shaft - Stainless steel to BS EN 10088.
  - Seal Housing - Cast iron to BS EN 1561.
- Bearings
  - Sealed-for-life or pre-packed type requiring no maintenance (in-line pumps).

- Glands and seals - Mechanical.

2010E GLANDLESS CIRCULATOR:
- Configuration
  - Glandless circulator incorporating inlet and outlet connections in line, to allow pump to be mounted in pipework.
- Pump efficiency
  - Comply with BS EN 16297-1 and BS EN 16297-2 for general requirements and procedures for testing and calculation of the Energy Efficiency Index (EEI) for stand-alone circulators.
  - Comply with BS EN 16297-1 and BS EN 16297-3 for general requirements and procedures for testing and calculation of the Energy Efficiency Index (EEI) for circulators integrated into products.
  - Include EEI of pump on name plate together with an indication of which part of BS EN 16297 was applied for the determination of the EEI.
- Motor
  - Provide electronically controlled permanent magnet type or EC motor.
  - Glandless circulators having a rated input of up to 200W to be tested in accordance with BS EN 16644 for structure and fluid borne noise.
- Casing
  - Provide casing with drain connection fitted with plug.
- Impeller
  - Ensure impellers are accurately machined and finished smooth, free from blowholes and other defects and designed to be in dynamic balance at all speeds.
  - Fix impellers to shafts to ensure that they remain firm if direction of rotation is reversed.
  - Indicate direction of rotation on pump casing.
- Shaft
  - Ensure shaft is of adequate diameter to withstand all imposed loading and has a critical speed when assembled with its impeller at least 10% above normal operating speed.
- Material
  - Casing - cast iron to BS EN 1561, or cast gunmetal to BS EN 1982
  - Impeller - manufacturer's standard.
  - Shaft - stainless steel to BS EN 10088
  - Seal Housing - manufacturer's standard.
- Bearings
  - Sealed-for-life or pre-packed type requiring no maintenance (in-line pumps).

2015 VARIABLE FLOW CONTROL:
- Supply centrifugal pump with variable speed drive for variable flow control. Variable speed drive to meet the safety requirements of BS EN 61800-5-1.
- Load characteristic
  - Variable torque centrifugal pumps.
  - Constant torque for positive displacement pumps.

4010 GENERAL:
- Comply with manufacturer's recommendations for installation of pumps. For in-line pumps ensure that motor is positioned in accordance with manufacturer's requirements.

4020 PIPELINE CONNECTIONS:
- Support pumps independently from connecting pipework to ensure no load is transmitted from pipework to pump casing on pump suction and discharge.

4040 ALIGNMENT:
- Align pump to prevent undue restraint and thrust on interconnecting pipework. Align drives to prevent undue wear and restraint on pump shaft. For belt drives, align pulleys and tension belts to prevent undue wear and out of balance forces.

4050 ACCESS:
- Locate pump within the system with adequate space around it for service and maintenance.

BS APPENDIX

BS EN 809:1998+A1:2009
Pumps and pump units for liquids. Common safety requirements

BS EN 1561:2011
Founding. Grey cast irons

BS EN 1982:2017
Copper and copper alloys. Ingots and castings

BS EN 10088-1:2014
Stainless steels. Part 1 List of stainless steels

BS EN 10088-2:2014
Stainless steels. Part 2 Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes

BS EN 10088-3:2014
Stainless steels. Part 3 Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes

BS EN 10088-4:2009
Stainless steels. Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes

BS EN 10088-5:2009
Stainless steels. Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels for construction purposes

BS EN 10226-1:2004
Pipe threads where pressure tight joints are made on the threads. Taper external threads and parallel internal threads. Part 1 dimensions, tolerances and designation

BS EN 10226-2:2005
Pipe threads where pressure tight joints are made on the threads. Taper external threads and taper internal threads. Dimensions, tolerances and designation

BS EN 10226-3:2005
Pipes threads where pressure-tight joints are made on the threads. Verification by means of limit gauges

BS EN 12756:2001
Mechanical seals. Principal dimensions, designation and material codes

BS EN 16297-1:2012
Pumps. Rotodynamic pumps. Glandless circulators. . General requirements and procedures for testing and calculation of energy efficiency index (EEI)

BS EN 16297-1:2012
Pumps. Rotodynamic pumps. Glandless circulators. . General requirements and procedures for testing and calculation of energy efficiency index (EEI)

BS EN 16297-2:2012
Pumps. Rotodynamic pumps. Glandless circulators. Calculation of energy efficiency index (EEI) for stand-alone circulators

BS EN 16297-2:2012
Pumps. Rotodynamic pumps. Glandless circulators. Calculation of energy efficiency index (EEI) for stand-alone circulators

BS EN 16297-3:2012
Pumps. Rotodynamic pumps. Glandless circulators. Energy efficiency index (EEI) for circulators integrated in products

BS EN 16297-3:2012
Pumps. Rotodynamic pumps. Glandless circulators. Energy efficiency index (EEI) for circulators integrated in products

BS EN 16480:2016
Pumps. Minimum required efficiency of rotodynamic water pumps

BS EN 16644:2014
Pumps. Rotodynamic pumps. Glandless circulators having a rated power input not exceeding 200 W for heating installations and domestic hot water installations. Noise test code (vibro-acoustics) for measuring structure- and fluid-borne noise

BS EN 60335-2-51:2003+A2:2012
Household and similar electrical appliances. Safety. Particular requirements for stationary circulation pumps for heating and service water installations

BS EN 61800-5-1:2007+A1:2017
Adjustable speed electrical power drive systems. Part 5-1 Safety requirements - Electrical, thermal and energy

BS EN ISO 5198:1999
Centrifugal, mixed flow and axial pumps. Code for hydraulic performance tests. Precision class

BS EN ISO 9906:2012
Rotodynamic pumps. Hydraulic performance acceptance tests. Grades 1, 2 and 3

BS EN ISO 9908:1998+A1:2011
Technical specifications for centrifugal pumps. Class III

Y23 STORAGE CYLINDERS AND CALORIFIERS

1010 STANDARDS:
- Comply with British Standards indicated.
- Unvented hot water storage systems to be completed with "unvented kits" and pressure regulating valve to comply with Building Regulations safety requirements within Approved Document G3. Indirectly heated storage water heaters to comply with BS EN 12897.

1020 DEFINITIONS:
- Direct cylinder - a closed cylindrical vessel with domed ends.
- Indirect cylinder - a closed cylindrical vessel with domed ends having separate integral means of heating contents by annular or coil type element.
- Combination unit - an indirect/direct cylinder of double or single feed type with attached feed cistern.
- Calorifier - a closed cylindrical vessel having separate integral means of heating contents by 'U' tube chest type element.
- Primary heater - a heater mounted inside a cylinder or calorifier for transfer of heat to stored water from primary medium.
- Capacity - the volume of water storage excluding contents of any primary heater.
- Secondary working head - the vertical distance between bottom of cylinder or calorifier and water line of cistern supplying cylinder or calorifier.

3010 GENERAL:
- Store, handle and erect all in accordance with manufacturer's recommendations and relevant British Standards.
- Make allowance for valves, fittings, access etc., to accommodate insulation/weathering where indicated.

3030 PROTECTION AND CLEANING:
- Ensure protection from damage and ingress of foreign matter to cylinders and calorifiers during storage, installation and testing.

3040 INSPECTION AND CLEANING:
- Install cylinders and calorifiers such that internal surfaces and external surfaces can be readily inspected and cleaned.

BS APPENDIX

BS EN 12897:2016
Water supply. Specification for indirectly heated unvented (closed) storage water heaters

Y25 CLEANING AND CHEMICAL TREATMENT

1010 CONDITIONS FOR CLEANING AND CHEMICAL TREATMENT:
- Ensure treatment complies with statutory authority and health and safety regulations.
- Notify manufacturer's and suppliers of equipment of proposed system cleaning and chemical treatment processes. Establish if any manufacturer or supplier of equipment requires any particular cleaning and chemical treatment process due to size of waterways or materials used.
- All chemicals used are to be compatible with the metallurgy of the systems.
- Obtain local water authority approval for disposal of any waste products.

1015 METHOD STATEMENT:
- Provide a method statement covering the sequence of events, chemicals to be used etc. Statement to be provided at least two months prior to the start of any flushing and/or chemical cleaning works.

2030A PRELIMINARY CHECKS:
- Prior to carrying out cleaning or chemical treatment process, ensure that
  - All foreign matter is removed.
  - Certified pressure tests have been carried out in the parts of the system to be cleaned. Carry out further pressure tests on the isolated sections of the system independently.
  - All water used for pressure testing is inhibited. Leave remaining pipework sections full after testing.
  - Where there is a risk of freezing a suitable inhibited glycol selected by the water treatment specialist is used.
  - Circulation has been demonstrated and approval obtained on all parts of the system. Manipulate and leave fully open all valves other than those used to isolate sections. Carry out balancing and certification after the flushing, cleaning and passivation operations.
  - No damage can occur to any item of plant or equipment due to cleaning and chemical processes.
  - Chemicals used are compatible with system materials.
  - All items of plant and equipment subject to damage or blockage due to cleaning and chemical treatment processes are isolated or removed.
  - Permanent or temporary by-passes are provided as indicated on drawings.
  - Dirt pockets are installed at low points to facilitate solids removal. Supply dirt pockets with drain valves sized to pipework size.
  - All drains provided have been tested and approved and that any pumping equipment associated with the drainage system is fully commissioned.
  - Dead legs, that are more than 3 pipe diameters in length are looped to allow effective cleaning.
  - Strainer baskets and filter media, incorporated within systems, are removed; and where necessary spool or stool pieces are installed.
  - Temporary strainers and filters are installed as required for removal of solids during cleaning and chemical treatment processes.
  - Strainers are clean prior to the start of the cleaning process, throughout the cleaning and on completion.
  - Suitable supply and drainage points are provided with 50mm minimum connections, properly sited and installed, either valved or plugged.
  - All automatic/manual air vents are fully commissioned.
  - Air vents of a minimum size of 25mm are installed at the tops of large flow risers.
  - All requirements of COSHH regulations are complied with during the chemical cleaning and chemical treatment of the system.
  - Where required by local water authority, provide effluent tanks for storage of all waste products of cleaning and chemical treatment processes.
  - Following local water authority approval, either neutralize and dispose to drain of all waste products; or ensure authorised disposal at registered sites.
  - Comply with Waste Management Duty of Care: Code of Practice and The Hazardous Waste (England & Wales) Regulations as amended.

2040A PROCEDURAL PRECAUTIONS FOR CLEANING AND CHEMICAL TREATMENT:
- Carry out tests to ensure that cleaning and chemical treatment processes are operating as required.
- Carry out tests to ensure that cleaning and chemical treatment processes are operating as required. and detailed in the Method Statement.

- Submit all test and sample results for certification and approval.

2040B PROCEDURAL PRECAUTIONS FOR CLEANING AND CHEMICAL TREATMENT INCLUDING TAKING SAMPLES:
- Take and test samples of the filling/flushing water and the system water, before, during and following chemical treatment and/or cleaning in accordance with BSRIA BG 29/2012, Section 3 and BS 8552.
- Submit samples to an independent specialist for analysis in accordance with BSRIA BG 29.
- Monitor water quality of systems after pre-commission cleaning up to practical completion in accordance with BSRIA BG 29/2012 Section 3.2.
- Submit all test and sample results for certification and approval.
- Ensure all contractually required samples are witnessed.

2050A WATER TREATMENT METHODS FOR HOT WATER HEATING CLOSED CIRCUIT RECIRCULATING SYSTEMS:
- Corrosion and scale control
  - Chemicals as BSRIA Guide BG 50/2013 Table 5.
- Control of microbiological fouling
  - Chemical.
  - Biocides and biodispersants. Chemicals as BSRIA BG 50/2013 Appendix C and European Biocidal Products Regulation (BPR) 528/2012.

2060A CHEMICAL INJECTION AND DOSING METHODS FOR CLOSED SYSTEMS:
- Method of introducing chemicals
  - Dosing pots.

2060C PACKAGED CHEMICAL INJECTION AND DOSING PLANT:
- Provide packaged monitoring and treatment plants.

2060D DOSING POTS - CLOSED SYSTEMS:
- Chemical feed
  - Provide feeder (dosing pots) with a tundish for filling; separate air vent with discharge tube; drain and isolating valves. Fabricate from mild steel tube to BS EN 10255, BS EN 10216 or BS EN 10217 to suit maximum working pressure of system.
- Sampling
  - Install in each water system means of taking samples as clause Y25.2070B and as follows:-
    - Chilled water systems - provide a gate valve and discharge.
    - Heating systems - provide a sample cooler with a copper coil and cooling jacket with cooling water valve and drained to waste.

2065 CHEMICALS - DOSING:
- Provide biocides effective against Legionella Pneumophila, algae, fungi, moulds and slime forming bacteria including pseudomonas and sulphate reducing bacteria.
- Supply biocides as recommended by water treatment specialist.
- Incorporate a bio dispersant in the programme to break up and disperse any slime masses, where required.
- Biocides to comply with European Biocidal Products Regulation (BPR) 528/2012.
- The water treatment specialist shall select the appropriate corrosion inhibitors, to minimise corrosion, and biocides to prevent any proliferation to mild steel, copper and copper alloys.
- Provide a specific inhibitor to protect aluminium when it is present in the system.
- The cleaning agent is to be specified by the water treatment specialist.

2070A MONITORING CLOSED SYSTEMS:
- For closed systems monitor system physical, chemical and bacterial levels from initial fill to practical completion in accordance with BSRIA BG 29/2012 and BS 8552.

2070B SAMPLING CLOSED SYSTEMS:
- For closed systems provide sampling points in accordance with BS 8552 and BSRIA BG 29/2012.
- Provide testing equipment to carry out tests for all inhibitors used in treatment programme indicated.

- Undertake sampling of closed systems in accordance with BSRIA BG 29/2012, Section 3 and Appendices A and B.
- Number and locations of samples in compliance with BG 29/2012, Appendix A.

2070C SAMPLING KITS:
- Provide the following test kits as appropriate
  - Boiler water test kit for steam boilers; conductivity test kit; pH test kit; inhibitor test kit; hardness test kit where a softener is installed; chloride level test kit.
- For open systems - bacteriology monitoring with use of dipslides.
- Log sheets for recording of test results, bacteriological analysis and any actions required or taken.

2070E SAMPLING HOT AND COLD WATER SERVICES:
- Standard
  - BS 8554 - Code of practice for the sampling and monitoring of hot and cold water services in buildings.
- Locate sampling points following the guidance and recommendations in the code of practice (CoP), and document these in a sampling plan in accordance with BS EN ISO 5667-1.
- Undertake sampling following construction completion in accordance with the guidance and recommendations in the CoP.
- Undertake microbiological test on samples and provide the results as part of the handover documentation to demonstrate that the systems are clear of organisms of concern. Preserve and handle samples in accordance with BS EN ISO 5667-3.

2080A CHEMICAL PROVISION, STANDARD ARRANGEMENT:
- Provide consumables for a period of 12 months.
- Where indicated, provide for supply of chemicals from containers refilled by drumless delivery system.
- Include for supply of chemicals for all systems using the basis of:
  - Open circuit systems operating at 100% load for 2080 hours per annum.
  - Closed circuit systems make-up 1% system volume/month.

3010B FLUSHING CLOSED PIPEWORK SYSTEMS:
- Carry out flushing of water systems in accordance with BSRIA Guide BG 29/2012 Pre-commission Cleaning of Pipework Systems.
  - Section 4 Installation Considerations.
  - Section 5 System Dynamic Flushing.
- Ensure all water used for pressure testing, flushing and system filling is of good quality. Clean and chlorinate temporary site mains to fill and flush closed systems in accordance with BS EN 806-4. Leave remaining pipework sections full and treated after pressure testing.
- Install all necessary pipework ancillaries to enable a specialist to carry out flushing, inspection and witnessing of water systems in accordance with BSRIA Guide BG 29. Connections between new and existing systems in accordance with BG 29/2012 Section 7.
- Temporary connection from the mains must be in compliance with
  - WRAS advisory topics B09 or B22.
  - England and Wales - The Water Supply (Water Fittings) Regulations 1999 as amended, the Water Act 2014 and the Construction Products Regulations 2013.
  - Scotland - The Water Supply (Water Fittings) Byelaws 2014.
  - Northern Ireland - The Water Supply (Water Fittings) Regulations 2009.
  - BSRIA BG 29/2012 Table 3 for pipe sizes when using mains water for flushing or installation of a temporary tank and pump arrangement shall be provided.
- Flush systems using mains water until the water is clear.

3010D FLUSHING SERVICES SUPPLYING WATER FOR DOMESTIC USE:
- Domestic water systems are to be flushed and disinfected in accordance with the requirements of BS EN 806-4, complimentary guidance in BS 8558 and PD 855468 and to the satisfaction of the local water supply authority.

3020A TESTING AND PURGING GAS PIPEWORK - INDUSTRIAL AND COMMERCIAL INSTALLATIONS:

- Comply with IGE/UP/1 Strength testing, tightness testing and direct purging of industrial and commercial gas installations.

3020B TESTING AND PURGING GAS PIPEWORK - SMALL LOW PRESSURE INDUSTRIAL AND COMMERCIAL INSTALLATIONS:

- For systems having a volume not exceeding $1m^3$ comply with IGE/UP/1A Strength testing, tightness testing and direct purging of small, low pressure industrial and commercial gas installations.

3030A CHEMICAL CLEANING AND SOLIDS REMOVAL - INHIBITED ACID:

- Carry out chemical cleaning procedure in accordance with BSRIA Guide BG 29/2012 Pre-commission Cleaning of Pipework Systems.

3030B CHEMICAL CLEANING AND SOLIDS REMOVAL - FORMULATED PRODUCTS:

- Carry out chemical cleaning procedure in accordance with BSRIA Guide BG 29/2012 Pre-commission Cleaning of Pipework Systems.

3040 DISINFECTION - GENERAL:

- After flushing process, carry out disinfection of water services systems in accordance with BS EN 806-4 and complimentary guidance in BS 8558 and PD 855468.
- Prior to disinfection ensure each system is flushed, cleaned and drained.
- Provide temporary connections to system terminal points suitable for introduction of disinfection chemicals and fluids and 22mm minimum valved drain connection on incoming main immediately downstream of mains isolating valve.
- Fill system with clean, fresh water.
- If the building is not occupied immediately after disinfection, put in hand a system for flushing all outlets to ensure system remains suitable for use when required.
- Repeat disinfection of potable water system immediately prior to handover if required.
- Immediately prior to occupation, retake samples and submit for analysis and report.

3050 DISINFECTION - HOT AND COLD WATER SERVICES SYSTEMS:

- Carry out the following operations in accordance with BS EN 806-4 and complimentary guidance in BS 8558 and PD 855468.
  - Flush system and introduce sterilisation chemical.
  - Agree a list of sentinel points (outlets in a water system that poses the highest risk from infection) prior to disinfection and take samples from these points to ensure correct chlorine concentration.
  - Leave system to stand for period of time indicated by the chemical manufacturer.
  - Repeatedly flush system with clean water until all traces of chlorine have been removed - leave system filled.
  - Submit samples to registered laboratory for microbiological analysis and report.
- Certificate of conformity
  - Immediately prior to handover, retake samples and submit for analysis and report.
- Where necessary repeat disinfection of potable water system immediately prior to handover.

3060 DISINFECTION - WATER STORAGE SYSTEMS:

- Carry out the following operations in accordance with BS EN 806-4, complementary guidance in BS 8558, PD 855468 and HSE L8 Legionnaires' Disease: The control of legionella bacteria in water systems ACOP and all parts of HSG274 (for technical guidance).
- Carry out operations on all water storage tanks and cisterns, cold and hot.
- Carry out procedures as for mains water systems.

3090 DOCUMENTATION:

- Provide number of copies as indicated of hard cover binders containing details of
  - Programme outlines.
  - Purpose of chemical treatment.
  - Chemicals used and quantity.
  - On site testing procedures.
  - Control limits of tests.
  - Equipment data and drawings.

- Product notes and material safety data sheets for all chemicals used.
- Provide a complete training programme for site operatives covering
  - Methods of basic water testing.
  - Explanation of results obtained.
  - Actions to be taken on test results.

BS APPENDIX

BS 8552:2012
Sampling and monitoring of water from building services closed systems. Code of practice

BS 8554:2015
Code of practice for the sampling and monitoring of hot and cold water services in buildings

BS 8558:2015
Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. Complementary guidance to BS EN 806

BS EN 806-4:2010
Specifications for installations inside buildings conveying water for human consumption. Part 4 Installation

BS EN 10216-1:2013
Seamless steel tubes for pressure purposes. Technical delivery conditions. Part 1 Non-alloy steel tubes with specified room temperature properties

BS EN 10216-2:2013
Seamless steel tubes for pressure purposes. Technical delivery conditions. Part 2 Non-alloy and alloy steel tubes with specified elevated temperature properties

BS EN 10216-3:2013
Seamless steel tubes for pressure purposes. Technical delivery conditions. Part 3 Alloy fine grain steel tubes

BS EN 10216-4:2013
Seamless steel tubes for pressure purposes. Technical delivery conditions. Part 4 Non-alloy and alloy steel tubes with specified low temperature properties

BS EN 10216-5:2013
Seamless steel tubes for pressure purposes. Technical delivery conditions. Part 5 Stainless steel tubes

BS EN 10217-1:2002
Welded steel tubes for pressure purposes. Technical delivery conditions. Part 1 Non-alloy steel tubes with specified room temperature properties

BS EN 10217-2:2002+A1:2005
Welded steel tubes for pressure purposes. Technical delivery conditions. Part 2 Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties

BS EN 10217-3:2002
Welded steel tubes for pressure purposes. Technical delivery conditions. Part 3 Alloy fine grain steel tubes

BS EN 10217-4:2002
Welded steel tubes for pressure purposes. Technical delivery conditions. Part 4 Electric welded non-alloy steel tubes with specified low temperature properties

BS EN 10217-5:2002
Welded steel tubes for pressure purposes. Technical delivery conditions. Part 5 Submerged arc

welded non-alloy and alloy steel tubes with specified elevated temperature properties

BS EN 10217-6:2002
Welded steel tubes for pressure purposes. Technical delivery conditions. Part 6 Submerged arc welded non-alloy steel tubes with specified low temperature properties

BS EN 10217-7:2014
Welded steel tubes for pressure purposes. Technical delivery conditions. Part 7 Stainless steel tubes

BS EN 10255:2004
Non-alloy steel tubes suitable for welding and threading. Technical delivery conditions

BS EN ISO 5667-1:2006, BS 6068-6.1:2006
Water quality. Sampling. Guidance on the design of sampling programmes and sampling techniques

BS EN ISO 5667-3:2018
Water quality. Sampling. Preservation and handling of water samples

PD 855468:2015
Guide to the flushing and disinfection of services supplying water for domestic use within buildings and their curtilages

Y30 AIR DUCTLINES AND ANCILLARIES

1010 DUCTWORK INSTALLATION STANDARDS:
- Carry out construction and installation of ductwork in accordance with, as appropriate
  - DW/144
  - DW/154
  - DW/172
  - DW/191
  - BS 9999
  - BS EN 1507
  - BS EN 12237
  - BS EN 13403

1020 DUCTWORK DIMENSIONS:
- Sizes of ductwork are internal dimensions. Where applicable make allowance for any internal lining.

1030 ELECTRICAL BONDING TERMINAL:
- Ensure an electrical bonding terminal is provided suitable for connection of a main protective conductor complying with BS 7671, clause 544.1.

2010A DESIGN INFORMATION - CLASS A POSITIVE:
- Supply ductwork in accordance with classification in DW/144 and DW/154 Table 1, BS EN 1507 Table 1 and BS EN 12237 Table 2.
- Ductwork classification and air leakage limits
  - Low pressure - Class A - Positive. (0.027 x $p^{0.65}$.l/s/m^2 duct surface).

2010B DESIGN INFORMATION - CLASS A NEGATIVE:
- Supply ductwork in accordance with classification in DW/144 and DW/154 Table 1, BS EN 1507 Table 1 and BS EN 12237 Table 2.
- Ductwork classification and air leakage limits
  - Low pressure - Class A - Negative.(0.027 x $p^{0.65}$.l/s/m^2 duct surface).

2030C LOW PRESSURE DUCTWORK AIR LEAKAGE TESTING:
- Test indicated or scheduled % of the low pressure ductwork for air leakage. Test at the pressure recommended in DW/144 for the classification of the selected ductwork as procedures set out in DW/143. Carry out the tests as the work proceeds and prior to application of thermal insulation.
- If the test fails, pressure test two further sections as indicated. If the further tests fail, apply remedial action to the complete ductwork system.
- Provide documented evidence of the calculations used to arrive at the allowable loss for the section to be tested and ensure the client or their agent witness and signs the results of the tests.
- Testing plant items as DW/144.

2035 STRENGTH AND LEAKAGE TESTING OF CIRCULAR SHEET METAL DUCTWORK:
- Carry out ductwork strength and air leakage testing on circular sheet metal ductwork in accordance with BS EN 12237.
- Test procedure shall be as detailed in BS EN 12237, Section 7.
- Produce a test report as detailed in BS EN 12237, Section 8.

2036 STRENGTH AND LEAKAGE TESTING OF RECTANGULAR SHEET METAL DUCTWORK:
- Carry out ductwork strength and air leakage testing on rectangular sheet metal ductwork in accordance with BS EN 1507.
- Test procedure shall be detailed in BS EN 1507.
- Produce a test report as detailed in BS EN 1507.

2065 KITCHEN EXTRACT SYSTEMS:
- Comply with BESA DW/172 Appendix D' and DW/144.
- Comply with Section 7 of BESA TR/19 for facilities and specific requirements for cleaning.
- Access doors for cleaning (with grease tight gaskets) shall be installed at every bend and connection

and at every 3m on straight lengths of ductwork. All joints shall be grease-tight.
- The entire system installation shall comply with all relevant Building Regulations and any specific requirements of the Building Control and Fire Officer.
- Ductwork - to be fire rated as scheduled or described in the Kitchen Ventilation Section.

2070 MAN ACCESS AND SAFETY BARS:
- Man access is required where indicated on drawings. Ensure that duct floor is of sufficient strength to comply with safety standards.
- Provide safety bars where indicated at the top of risers.

2110A FIRE PROTECTION WITH FIRE DAMPERS:
- Method of protection where ventilation ducts pass through fire-separating elements
  - BS 9999 method 1 and method 4 protection using fire dampers and/or automatically actuated fire and smoke dampers triggered by smoke detectors.
- Installation to comply with
  - BESA DW/144 and DW/145
  - Building Regulations Approved Document B
  - BS EN 15650 Ventilation for buildings. Fire dampers
  - Relevant parts of BS EN 1366, BS EN 13501 and BS EN 12101

2110B FIRE PROTECTION WITH FIRE RESISTING ENCLOSURES:
- Method of protection where ventilation ducts pass through fire-separating elements
  - BS 9999 method 2 using fire-resisting enclosures.
- Installation to comply with
  - BESA DW/144
  - Building Regulations Approved Document B
  - Relevant parts of BS EN 1366, BS EN 13501 and BS EN 12101

2110E FIRE RESISTING DUCTWORK TESTED TO BS EN 1366:
- Supply and install fire resisting ductwork using either fire protection cladding on-site, factory applied fire resisting finish or factory manufactured fire rated ductwork, as detailed elsewhere in this specification. Ductwork to be in accordance with BESA DW/144.
- Duct constructed to BESA DW/144 has no tested fire resistance, therefore when using protective cladding materials, construction of base duct must comply with the actual construction of the tested duct specimen and cladding material.
- Method of protection where ventilation ducts pass through fire-separating elements
  - BS 9999 method 3: protection using fire-resisting ductwork.
- Ensure complete ductwork system complies with EN testing requirements to BS EN 1366-1, be tested by a UKAS accredited notified body and comply with Building Regulations Approved Document B.
- Classification documents to be in accordance with BS EN 13501-3 for ventilation ducts, the ductwork providing either duct Type A (fire outside) or duct Type B (fire inside). Documents to confirm that systems are suitable for horizontal and vertical applications; and in both rectangular and circular profiles; and any size limitations under the relevant BS EN 1366 test part must be confirmed.
- Where the ductwork passes between fire compartments, fire stopping shall be carried out by the specialist in accordance with the ductwork manufacturer's recommendations; and the ductwork shall be reinforced in line with that used within the actual fire test; and be relevant to flexible or rigid wall / floor constructions. The ductwork shall be stiffened to prevent deformation of the duct in a fire to maintain the cross-sectional area of the duct and ensure that the fire rated penetration seal around the duct is not compromised.
- The specialist ductwork contractor shall be responsible for the design and sizing of the drop rods and bearers (and their centres) for the fire resisting ductwork to suit the fire duration scheduled.
- Drop rods and exposed bearers to be insulated in accordance with manufacturers recommendations and instructions.
- All fire insulation, sealants, gaskets and flexible joints must be non-flammable when tested.
- Where a vapour barrier is required, all exposed edges and penetrations through the foil should be sealed using soft self-adhesive aluminium foil tape.

2110F FIRE RESISTING AND SMOKE / HEAT CONTROL DUCTWORK TESTED TO BS EN 1366:
- Supply and install fire resisting ductwork using either fire protection cladding on-site, factory applied fire resisting finish or factory manufactured fire rated ductwork, as detailed elsewhere in this specification. Ductwork to be in accordance with BESA DW/144.
- Duct constructed to BESA DW/144 has no tested fire resistance, therefore when using protective cladding materials, construction of base duct must comply with the actual construction of the tested duct specimen and cladding material.
- Method of protection where ventilation ducts pass through fire-separating elements
  - BS 9999 method 3: protection using fire-resisting ductwork.
- Ensure complete ductwork system complies with EN testing requirements to BS EN 1366-1, BS EN 1366-8 or BS EN 1366-9 depending on system function, be tested by a UKAS accredited notified body and comply with Building Regulations Approved Document B. Smoke extract ducts to conform to the requirements of BS EN 12101-7.
- Classification documents to be in accordance with BS EN 13501-3 for ventilation ducts and BS EN 13501-4 for smoke control ducts sections. Documents to confirm that systems are suitable for horizontal and vertical applications; and in both rectangular and circular profiles; and any size limitations under the relevant BS EN 1366 test part must be confirmed.
- The ductwork providing either duct Type A (fire outside), duct Type B (fire inside) or duct Type C (fire inside smoke control duct). All smoke extract ductwork to be capable of retaining a cross-sectional area of 90% under fire conditions in accordance with BS EN 1366-8 for multi compartment smoke extract systems.
- Where the ductwork passes between fire compartments, fire stopping shall be carried out by the specialist in accordance with the ductwork manufacturer's recommendations; and the ductwork shall be reinforced in line with that used within the actual fire test; and be relevant to flexible or rigid wall / floor constructions. The ductwork shall be stiffened to prevent deformation of the duct in a fire to maintain the cross-sectional area of the duct and ensure that the fire rated penetration seal around the duct is not compromised.
- The specialist ductwork contractor shall be responsible for the design and sizing of the drop rods and bearers (and their centres) for the fire resisting ductwork to suit the fire duration scheduled.
- Drop rods and exposed bearers to be insulated in accordance with manufacturers recommendations and instructions.
- All fire insulation, sealants, gaskets and flexible joints must be non-flammable when tested.
- Where a vapour barrier is required, all exposed edges and penetrations through the foil should be sealed using soft self-adhesive aluminium foil tape.

2120A INTERNAL THERMAL/ACOUSTIC INSULATION:
- Fit internal linings at works in accordance with DW/144..

2140A HANGERS AND SUPPORTS:
- Provide hangers and supports throughout in accordance with DW/144; DW/154 Part 5; or DW/191 Section 7 as appropriate.
- Comply with BS EN 12236.

2150A SUPPORT OF AIR TERMINAL UNITS:
- Support air terminal units and their plenums by the ceiling grids, as DW/144.

3010 CONSTRUCTION AND FINISHES:
- Ensure that materials of accessories are compatible with ductwork and that finishes of accessories comply with any special requirements for ductwork.
- Ensure casing losses of components are compatible with ductwork in which they are incorporated.

3020A METAL DUCTWORK INSPECTION/SERVICING ACCESS OPENINGS:
- Provide access/inspection openings in accordance with DW/144.

3020D DUCTWORK INSPECTION/SERVICING ACCESS OPENINGS:
- Provide access/inspection openings in accordance with BESA TR/19.

3030A METAL DUCTWORK TEST HOLES:
- Provide test holes in ductwork system, as shown on drawings, to allow complete testing and

balancing of system in accordance with CIBSE Commissioning Code A.
- Site drill test holes in accordance with BESA DW/144.

3040 HOLES FOR CONTROLS/INSTRUMENTS - METAL DUCTWORK:
- Provide holes in ductwork, in accordance with BESA DW/144 to accommodate thermostats, humidistats and other control sensors in positions and sizes indicated on drawings.

3042 INSTALLATION OF INSTRUMENTS AND CONTROLS:
- Instruments and controls should be installed to manufacturers or specialist supplier's requirements. The installation must be checked by the manufacturer or specialist supplier, and rectified as necessary.

3050B CLEANING ACCESS - INTERMEDIATE LEVEL OF PDI:
- Provide access for cleaning in accordance with BESA documents DW/144 and TR/19.

3060A STEEL SINGLE-BLADE BALANCING DAMPERS - METAL DUCTS:
- Provide single or double skin steel single blade balancing dampers in accordance with DW/144. Manual operation. Locations and size as shown on drawings.
- Undertake aerodynamic testing of dampers in accordance with BS EN 1751.
- Where required, determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.

3060B STEEL MULTI-BLADE BALANCING DAMPERS - METAL DUCTS:
- Provide single or double skin steel multi-blade balancing dampers in accordance with DW/144. Parallel or opposed blade, manual operation. Locations and size as shown on drawings.
- Undertake aerodynamic testing of dampers in accordance with BS EN 1751.
- Where required, determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.

3060C STEEL SINGLE-BLADE CONTROL DAMPERS - METAL DUCTS:
- Provide single or double skin steel single blade control dampers in accordance with DW/144. Locations and size as shown on drawings.
- Aerodynamic testing of dampers in accordance with BS EN 1751.
- Where required, determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.

3060D STEEL MULTI-BLADE CONTROL DAMPERS - METAL DUCTS:
- Provide single or double skin steel multi-blade control dampers in accordance with DW/144. Parallel or opposed blade, automatic operation. Locations and size as shown on drawings.
- Undertake aerodynamic testing of dampers in accordance with BS EN 1751.
- Where required, determination of sound power levels to be by measurement in a reverberation room in accordance with BS EN ISO 5135.

3070A STEEL CURTAIN FIRE DAMPERS - BLADES IN AIR STREAM:
- Supply and install steel folding curtain fire dampers, with blades partially in the air stream, in accordance with DW/144 and BS EN 15650, size and location as shown on the drawings.
- Where required undertake aerodynamic testing of fire dampers in accordance with BS EN 1751.
- Fire-resistance tests of thermal release mechanism in accordance with BS ISO 10294-4.

3070I INTUMESCENT FIRE DAMPERS:
- Supply and install intumescent fire dampers in accordance with DW/144 and BS EN 15650, size and location as shown on the drawings.
- Fire resistance tests for intumescent dampers shall be in accordance with BS ISO 10294-5

3070J FIRE DAMPERS ACCESSORIES:
- Provide accessories compatible with fire dampers. Electrical cut-out switches and external visual indication of fire damper blade position.
- Supply spare fusible links for fire dampers to fuse at 72°C as specified in DW/144.

3075 FIRE DAMPERS - GENERAL:

- Types to be as identified elsewhere in the specification, in schedules or on drawings.
- Fire dampers shall be supplied and fixed in accordance with the manufacturer's recommendations and installation methods which conform to the prevailing Building Regulations (ADB) and are acceptable to the District Surveyor/Building Control Officer and Fire Officer generally in accordance with DW/144 and DW/145 or DW/154. The proposed installation method must be supported by a valid test report or assessment provided by an approved third party notified body.
- The construction shall allow for all additional framing supports, bracing and fire stopping as may be necessary to adequately attach/install the fire dampers to the structure. The assembly is to be approved by the Building Control Officer/District Surveyor and Fire Officer.
- Each fire damper and associated installation method shall have at least the same standard of fire integrity as the wall or floor through which the duct passes.
- Where required undertake aerodynamic testing of fire dampers in accordance with BS EN 1751.
- The classification of fire dampers is to be in accordance with BS EN 13501-3 and shall have an integrity classification 'E' to meet that of the wall or floor.
- When a fire integrity of 4 hours is required, either 2 dampers (classified E120) factory assembled in series (if acceptable to the Local Authority) or a single damper having a classification E240, may be used.
- To achieve these classifications, fire resistance tests shall be in accordance with BS EN 1366-2, undertaken by a notified body.
- Shutter dampers shall be provided with the shutter blades located outside the air stream (unless other wise indicated). Each damper shall have a stainless steel curtain in all-welded galvanized steel casing with stainless steel side seal gaskets. The damper blade curtain shall be held in the folded position by a dual safe thermal actuator and fusible link.

All damper blades shall be tensioned to ensure instantaneous closure on thermal activation at 72°C (unless specified elsewhere). A self-latching reset mechanism shall be provided for easy re-setting of the damper curtain.

- On completion of the installation, the contractor shall be responsible for ensuring the inspection and testing of all fire dampers installed are carried out. Upon completion of the tests, the certificates must be issued for confirming that the dampers have been inspected and that they function correctly in accordance with the manufacturer's data sheets.
- Access panels with chains shall be provided adjacent to the access side of all fire dampers.
- In no instances shall flexible duct connections be allowed onto fire dampers through walls or floors. Approved flexible connectors for breakaway joints, or duct expansion in case of fire, may be used in association with fire dampers.
- Provide local external visual indication of fire damper blade position, unless indicated otherwise.

3089 COMBINATION FIRE AND SMOKE DAMPERS - GENERAL:

- Types to be as identified elsewhere in the specification, in schedules or on drawings.
- Combination smoke and fire dampers shall be supplied and fixed in accordance with the manufacturer's recommendations and installation methods which conform to the prevailing Building Regulations (ADB) and are acceptable to the District Surveyor/Building Control Officer generally in accordance with DW/144 and DW/145 or DW/154. The proposed installation method must be supported by a valid test report or assessment provided by an approved third party notified body.
- The construction shall allow for all additional framing supports, bracing and fire stopping as may be necessary to adequately attach/install the fire dampers to the structure. The assembly is to be approved by the Building Control Officer/District Surveyor and Fire Officer.
- Each combination smoke and fire damper and associated installation method shall have at least the same standard of fire integrity as the wall or floor through which the duct passes.
- Where required undertake aerodynamic testing of fire dampers in accordance with BS EN 1751.
- The classification of combination fire and smoke dampers is to be in accordance with BS EN 13501-4 and shall have an integrity classification 'E' to meet that of the wall or floor supported with an 'ES' classification of at least 60 minutes, unless the wall or floor requires less than this (e.g. 30 minutes).
- When a fire integrity of 4 hours is required, either 2 dampers (classified E120, ES60 (min) factory assembled in series (if acceptable to the Local Authority) or a single damper having a classification E240, ES60 (min)), may be used.
- To achieve these classifications, fire resistance tests shall be in accordance with BS EN 1366-2 and BS EN 1366-10, undertaken by a notified body.
- Combination fire and smoke dampers tested ad-hoc to BS 476-20 and BS 476-22 shall be permitted

only under conditions where the Building Regulations (ADB) specifically allow. This requirement shall be confirmed before supplying such tested product.
- Combination smoke and fire dampers shall be of the single blade or multi blade type as indicated elsewhere in this specification. Damper blades shall be released from their open position by means of either a thermal release device rated at a temperature indicated elsewhere in this specification, or via a mechanical actuator connected to a smoke alarm or control system, or a combination of both dependent on the control mode selected.
- On completion of the installation, the contractor shall be responsible for ensuring the inspection and testing of all combination smoke and fire dampers installed are carried out. Upon completion of the tests, the certificates must be issued for confirming that the dampers have been inspected and that they function correctly in accordance with the manufacturer's data sheets.
- Access panels with chains shall be provided adjacent to the access side of all combination smoke and fire dampers.
- In no instances shall flexible duct connections be allowed through walls or floors. Approved flexible connectors for breakaway joints, or duct expansion in case of fire, may be used in association with combination smoke and fire dampers.
- Provide local external visual indication of combination smoke and fire damper blade position, unless indicated otherwise.

3090A STEEL SINGLE BLADE COMBINATION SMOKE AND FIRE DAMPERS:
- Supply and install single blade combination smoke and fire dampers in accordance with DW/144 and BS EN 15650, size and location as shown on the drawings.
- Where required undertake aerodynamic testing of fire dampers in accordance with BS EN 1751.
- Fire-resistance tests of thermal release mechanism in accordance with BS ISO 10294-4.

3090B STEEL MULTI-BLADE COMBINATION SMOKE AND FIRE DAMPERS:
- Supply and install multi-blade combination smoke and fire dampers in accordance with DW/144 and BS EN 15650, size and location as shown on the drawings.
- Where required undertake aerodynamic testing of fire dampers in accordance with BS EN 1751.
- Fire-resistance tests of thermal release mechanism in accordance with BS ISO 10294-4.

3100A COATED STEEL FLEXIBLE DUCTS:
- Supply and fasten coated steel flexible duct connections as DW/144. Use flexible duct connections in applications listed in DW/144.
- Comply with BS EN 13180 and provide a test certificate proving compliance with the mechanical characteristics of this standard.
- Ductwork and insulation to have a test certificate proving reaction to fire performance requirements of BS 9999. Materials to conform to Euroclass A1 as specified in BS EN 13501 or when tested to BS 476-6 has a fire propagation index of not more than 12 and a sub-index of not more than 6.
- Maximum length 600mm.

3100C PVC/POLYESTER LAMINATE FLEXIBLE DUCTS:
- Supply and fasten PVC/polyester laminate flexible duct connections as DW/144. Use flexible duct connections in applications listed in DW/144.
- Comply with BS EN 13180 and provide a test certificate proving compliance with the mechanical characteristics of this standard
- Ductwork and insulation to have a test certificate proving reaction to fire performance requirements of BS 9999. Materials to conform to Euroclass A1 as specified in BS EN 13501 or when tested to BS 476-6 has a fire propagation index of not more than 12 and a sub-index of not more than 6.
- Maximum length 600mm.

3100D ALUMINIUM/POLYESTER FLEXIBLE DUCTS:
- Supply and fasten flexible duct connections as DW/144. Use flexible duct connections in applications listed in DW/144.
- Material - Aluminium/Polyester laminate encapsulating high tensile steel wire helix.
- Comply with BS EN 13180 and provide a test certificate proving compliance with the mechanical characteristics of this standard.
- Ductwork and insulation to have a test certificate proving reaction to fire performance requirements of BS 9999. Materials to conform to Euroclass A1 as specified in BS EN 13501 or when tested to BS

476-6 has a fire propagation index of not more than 12 and a sub-index of not more than 6.
- Maximum length 600mm.

3110A FLEXIBLE JOINT CONNECTIONS:
- Supply and install flexible joint connections as detailed in DW/144 or DW/154 Section 18, as appropriate.
- Use flexible joints, as shown on drawings; on fan inlet/outlets; and on building expansion joints.
- All flexible joint connections shall comply with current Building Regulations regarding the spread of fire and smoke.

3120A BIRD WIRE GUARDS:
- Fit bird screens of 13mm square mesh wire on all intake and extract louvres to atmosphere. Wire gauge to be not less than 1mm.
- Finish - Plastic coated wire.

3130A INSECT GUARDS:
- Provide manufacturer's standard insect guards where indicated. Screens to be factory fitted by the manufacturer.
  - Material: Woven wire cloth.
  - Mesh: 16.
  - Gauge: 28.
  - Wire diameter: 0.375 mm.
  - Aperture: 1.212 mm^2.
  - Free area: 58%.

4010 GENERAL WORKMANSHIP:
- Install ductwork in accordance with DW/144, DW/154 and DW/191 as appropriate.
- Ensure that there are no sharp edges or corners on cut edges on ductwork, flanges and supports.
- Install pre-insulated ductwork to BS EN 13403 in accordance with manufacturer's instructions.

4015 FLEXIBLE DUCTWORK INSTALLATION:
- Comply with BSRIA Guide BG43. Flexible ductwork.
- Minimum radius ratio (R/D) to be not less than 2, where R is the centre line radius and D is the duct diameter.
- Maximum support interval – 600mm.
- Support rings to be sized so as not to constrict the cross-sectional area of the ductwork.
- Duct support ring minimum width – 25mm.
- Flexible ducts to overlap rigid duct or terminal device spigot by a minimum of 50mm.
- Make a seal between flexible duct and rigid connection using mastic sealant or duct tape
- Use a mechanical fixing for connection using a duct band.

4020 DUCTWORK SUPPORTS:
- Support ductwork in accordance with DW/144; DW/154 Part 5; or DW/191 Section 7 as appropriate. Install supports to ensure insulation can be applied unless otherwise indicated.

4025 COMPONENT SUPPORT ON PRE-INSULATED ALUMINIUM DUCTWORK:
- Support ducts with dimensions less than 1m at intervals of no more than 4m. Support ducts with dimensions over 1m at intervals of no more than 2m.

Provide independent support for all accessories.

4030A DUCT SUPPORT FOR VAPOUR SEAL CONTINUITY:
- Where a vapour seal is required, use method of support detailed on drawing as indicated.

4040 EXTERNAL DUCTWORK SUPPORTS:
- Support ductwork external to building as indicated.
- Comply with BESA DW/144 Section 26.
- All supports shall either be constructed from mild steel structural sections and galvanised after manufacture or fabricated using a proprietary support system / support feet to assist in spreading the

weight on a roof membrane. Submit proposals to Designer and Structural Engineer for comment.
• Particular care should be taken in selecting structural fixings that will provide a life cycle appropriate to the buildings intended use. All supports and fixings shall comply with Local Authority requirements. Obtain approval from the Local Authority where required.

4060 DRAINAGE OF DUCTWORK:
• Arrange ductwork to drain any entrained moisture and ensure the lapping of joints minimises moisture leakage.

4090B INTERNAL CLEANLINESS - INTERMEDIATE LEVEL:
• Provide Intermediate Level of protection, delivery and installation as defined in BESA TR/19.

4090D DRY METHOD OF CLEANING:
• The specialist cleaning contractor shall select and propose for approval the most appropriate cleaning method from table 8 in BESA TR/19.

4090E WET METHOD OF CLEANING:
• The specialist cleaning contractor shall select and propose for approval the most appropriate cleaning method from table 8 in BESA TR/19.
• The system should be thoroughly dried prior to commissioning/de-commissioning to prevent moisture assisting in the growth of micro-organisms.
• A risk assessment must be carried out before any cleaning chemicals or biocides are considered. The details of any such chemicals or biocides must be recorded and any adverse effects of the applied chemicals assessed and determined, with appropriate safe procedures set out in a formal method statement.
• Steam cleaning and high pressure water wash are not recommended for ductwork that is situated above ceilings or in sensitive areas unless carried out in a controlled manner to contain leakage. Procedures to take account of operative safety must be adopted, and should be set out in written form.
• Careful consideration should be given to the use of chemicals and/or water for surfaces that are porous e.g. internally-lined ductwork, attenuators, fibre board ductwork, attenuators, fibre board ductwork etc., to prevent permanent damage.
• Before applying wet cleaning methods care should be taken that condensed vapours and cleaning fluids can be removed from the ductwork system.

4100A WEATHERPROOFING:
• Fit ductwork with trimming angle and weather cravat, skirt, flashing plate and cowl where ductwork passes through or terminates in roof, to ensure a weatherproof seal to building structure, as indicated.

4110B DUCTWORK SLEEVES WITH FLANGES:
• Where indicated, enclose ducts passing through building elements, (walls, floors, partitions, etc.) within purpose made sleeves. Cut sleeves of the same material as the duct and pack with mineral fibre or similar non-flammable and fire resistant material to form a fire/smoke stop of adequate rating and to prevent air movement and noise transmission between duct and sleeve.
• Provide flanges on either side of wall where ductwork is exposed in rooms.
• Where finished insulation is carried through duct sleeves. Pack space between insulation finish and sleeve with non-flammable and fire resistant material to form fire stop.

4130 INSTALLATION OF CONTROL EQUIPMENT:
• Fit sensors, damper motors and other control equipment as indicated.
• All control equipment should be installed to manufacturer or specialist supplier's requirements. The installation must be checked by the manufacturer or specialist supplier, and rectified as necessary.

4140 INSTRUMENT CONNECTIONS:
• Provide instrument connections where indicated.
• All instrument connections should be installed to manufacturer or specialist supplier's requirements. The installation must be checked by the manufacturer or specialist supplier, and rectified as necessary.

4160 DAMPER ACCESS:

• Ensure access is provided to damper mechanisms on fire dampers; smoke dampers; combined smoke and fire dampers; and volume control dampers through access doors, false ceilings etc..
• Demonstrate that damper blades close completely.
• Demonstrate that fire links can be replaced. Where more than one fire damper is installed in a frame ensure access is provided to all fire dampers.

BS APPENDIX

BS 476-6:1989+A1:2009
Fire tests on building materials and structures. Part 6 Method of test for fire propagation for products

BS 476-20:1987
Fire tests on building materials and structures. Part 20 Method for determination of the fire resistance of elements of construction (general principles)

BS 476-22:1987
Fire tests on building materials and structures. Part 22 Method for determination of the fire resistance of non-loadbearing elements of construction

BS 7671:2018
Requirements for electrical installations. IET Wiring Regulations

BS 9999:2017
Fire safety in the design, management and use of buildings. Code of practice

BS EN 1366-1:2014
Fire resistance tests for service installations. Ventilation ducts

BS EN 1366-2:2015
Fire resistance tests for service installations. Part 2 Fire dampers

BS EN 1366-3:2009
Fire resistance tests for service installations. Penetration seals

BS EN 1366-4:2006+A1:2010
Fire resistance tests for service installations. Linear joint seals

BS EN 1366-5:2010
Fire resistance tests for service installations. Service ducts and shafts

BS EN 1366-6:2004
Fire resistance tests for service installations. Part 6 Raised access and hollow core floors

BS EN 1366-7:2004
Fire resistance tests for service installations. Part 7 Conveyor systems and their closures

BS EN 1366-8:2004
Fire resistance tests for service installations. Part 8 Smoke extraction ducts

BS EN 1366-9:2008
Fire resistance tests for service installations. Single compartment smoke extraction ducts

BS EN 1366-10:2011+A1:2017
Fire resistance tests for service installations. Part 10 Smoke control dampers

BS EN 1366-12:2014
Fire resistance tests for service installations. Non-mechanical fire barrier for ventilation ductwork

BS EN 1507:2006+A1:2010
Ventilation for buildings. Sheet metal air ducts with rectangular section. Requirements for strength and

leakage

BS EN 1751:2014
Ventilation for buildings. Air terminal devices. Aerodynamic testing of damper and valves

BS EN 12101-1:2005+A1:2006
Smoke and heat control systems. Specification for smoke barriers

BS EN 12101-2:2017
Smoke and heat control systems. Natural smoke and heat exhaust ventilators

BS EN 12101-3:2015
Smoke and heat control systems. Specification for powered smoke and heat control ventilators (Fans)

BS EN 12101-6:2005
Smoke and heat control systems. Part 6 Specification for pressure differential systems. Kits

BS EN 12101-7:2011
Smoke and heat control systems. Part 7 Smoke duct sections

BS EN 12101-7:2011
Smoke and heat control systems. Part 7 Smoke duct sections

BS EN 12101-8:2011
Smoke and heat control systems. Part 8 Smoke control dampers

BS EN 12101-10:2005
Smoke and heat control systems. Part 10 Power supplies

BS EN 12236:2002
Ventilation for buildings. Ductwork hangers and supports. Requirements for strength

BS EN 12237:2003
Ventilation for buildings. Ductwork. Strength and leakage of circular sheet metal ducts

BS EN 13180:2002
Ventilation for buildings. Ductwork. Dimensions and mechanical requirements for flexible ducts

BS EN 13403:2003
Ventilation for buildings. Non metallic ducts. Ductwork made from insulation ductboards

BS EN 13501-1:2018
Fire classification of construction products and building elements. Classification using test data from reaction to fire tests

BS EN 13501-2:2016
Fire classification of construction products and building elements. Classification using data from fire resistance tests, excluding ventilation services

BS EN 13501-3:2005+A1:2009
Fire classification of construction products and building elements. Part 3 Classification using data from fire resistance tests on products and elements used in building service installations: fire resisting ducts and fire dampers

BS EN 13501-3:2005+A1:2009
Fire classification of construction products and building elements. Part 3 Classification using data from fire resistance tests on products and elements used in building service installations: fire resisting ducts and fire dampers

BS EN 13501-4:2016

Fire classification of construction products and building elements. Classification using data from fire resistance tests on components of smoke control systems

BS EN 13501-4:2016
Fire classification of construction products and building elements. Classification using data from fire resistance tests on components of smoke control systems

BS EN 13501-5:2016
Fire classification of construction products and building elements. Classification using data from external fire exposure to roofs tests

BS EN 13501-6:2014
Fire classification of construction products and building elements. Classification using data from reaction to fire tests on electric cables

BS EN 15650:2010
Ventilation for buildings. Fire dampers

BS EN ISO 5135:1999
Acoustics. Determination of sound power levels of noise from air-terminal devices, air-terminal units, dampers and valves by measurement in a reverberation room

BS ISO 10294-4:2001+A1:2014
Fire-resistance tests. Fire dampers for air distribution systems. Test of thermal release mechanism

BS ISO 10294-5:2005
Fire-resistance tests. Fire dampers for air distribution systems. Part 5 Intumescent fire dampers

Y40 AIR HANDLING UNITS

1000 GENERAL:
- Comply with BS EN 1886 for mechanical performance of air handling units as a whole. Refer to particular specification or schedules for casing strength, air leakage, thermal transmittance and thermal bridging classifications and general acoustics performance requirements.
- Comply with BS EN 13053 for testing for ratings and performance of air handling units as a whole and components and sections within units.

1010B CASING AIR LEAKAGE:
- Ensure air handling unit is sealed to minimise air leakage at design pressure.
- AHU leakage rate shall not exceed the maximum rate defined in BS EN 1886 for the leakage class of casing scheduled or detailed in the particular specification.
- Test pressure
  - 400Pa negative and 700Pa positive.

1010C FILTER BYPASS LEAKAGE:
- Filter bypass leakage, at 400Pa test pressure, shall not exceed the acceptable maximum % of volume flow rate defined in BS EN 1886 for the class of filter scheduled or detailed in the particular specification.

1020 FAN SELECTION:
- Air volume
  - Ensure scheduled volume is provided when operating against resistance of system corrected for changes between specified and selected component resistance.
- System resistance
  - Adjust scheduled resistance to compensate for actual resistance of selected components.
- Operating point
  - Select operating point on pressure/volume curve to provide stable and efficient operation.
  - Whenever possible the fan supplier shall select fans over the range of air flows where the efficiency is not less than 85% of the optimum efficiency in accordance with Annex E in BS EN ISO 12759
- Fans driven by electric motors with electric input between 125W and 500kW to comply with EU Regulation 327/2011 with regard to ecodesign requirements.
- Guaranteed performance
  - Provide fan performance figures in accordance with
  - BS EN ISO 5801
  - BS 848-9

2020B MANUFACTURER'S STANDARD DOUBLE SKIN CASING AIR HANDLING UNITS:
- Outer skin material - Manufacturer's standard.
- Inner skin material - Manufacturer's standard.
- External casing finish - Manufacturer's standard.
- Internal casing finish - Manufacturer's standard.

2030B AIR HANDLING UNIT CONSTRUCTION:
- General construction
  - Construct unit to withstand maximum fan static pressure without plastic deformation.
  - Ensure panels do not deflect by more than the values given in BS EN 1886 when in operation and withstand maximum fan pressure at design fan speed. No permanent deformation (hysteresis maximum +/- 2.0 mm per m frame/panel span) of the structural parts (structures and supports) or damage of the casing may occur
    - Casing strength Class D1 - 4 mm/m maximum relative deflection.
    - Casing strength Class D2 - 10 mm/m maximum relative deflection.
    - Casing strength Class D3 - exceeding 10 mm/m maximum relative deflection.
  - Use corrosion resistant fastenings throughout.
  - Do not use self tapping screws.
  - Provide panel gaskets to give a durable seal between panels and frames to prevent excessive air

leakage.
  - Construct unit to avoid thermal bridging.
- Provide stacking units where indicated.
- Casing thermal performance
  - Ensure the casing thermal performance is tested in accordance with the requirements of BS EN 1886
  - Thermal transmittance U of the casing shall be classified in accordance with BS EN 1886
    - Thermal transmittance Class T1 - less than or equal to 0.5
    - Thermal transmittance Class T2 - greater than 0.5 up to 1.0
    - Thermal transmittance Class T3 - greater than 1.0 up to 1.4
    - Thermal transmittance Class T4 - greater than 1.4 up to 2.0
    - Thermal transmittance Class T5 - no requirements.
  - Thermal bridging factors kb shall be classified in accordance with BS EN 1886
    - Thermal bridging factor Class TB1 - greater than 0.75 but less than 1.0
    - Thermal bridging factor Class TB2 - greater than 0.6 but less than 0.75
    - Thermal bridging factor Class TB3 - greater than 0.45 but less than 0.6
    - Thermal bridging factor Class TB4 - greater than 0.3 but less than 0.45
    - Thermal bridging factor Class TB5 - no requirements.
- Casing acoustic performance
  - Ensure that the sound insertion loss of the unit is determined in accordance with BS EN 1886
- Casing Insulation
  - Ensure insulation complies with BS 476-7. Ensure insulation is fixed securely to panel, and protected to prevent migration of fibre into air flow.
  - Insulation to provide thermal, structural or acoustic treatment as indicated.
  - Ensure insulation is vapour sealed throughout and incorporate thermal breaks.
  - Insulation material
    - Provide insulation that is inorganic, vermin proof and non-hygroscopic.
    - Use mineral fibre, minimum of 50mm thick, CFC free rigid polyurethane foam, minimum of 25 mm thick or CFC free injected polyurethane foam, minimum 25 mm thick.
- Framework
  - Ensure framework is rigid enough to prevent distortion during transportation and after final assembly on-site.
  - Seat panels into folded, rolled or extruded frame with purpose made corner joints; or pentapost type frame with purpose made corner joints.
  - Ensure framework is self supporting.
  - For vertical units strengthen framework to support additional weight.
- Base
  - Provide feet under each section; formed base; or RSC base.

2040A AIR HANDLING UNIT ACCESS:
- Provide access openings and covers complete with opening devices, and sealed to prevent air leakage.
- Ensure seals are designed for normal maintenance operations for a minimum of 10 years.
- Provide hinged access doors, 400mm minimum width.
- Operating device - key operated door locks.
- Provide access to fans, dampers, filters, spray coils, humidifiers and within air handling unit for inspection of nozzles and tanks.

3010A FAN SECTION:
- Provide frame for motor and fan and comply with fire regulations.
- Ensure frame is isolated from casing.
- For blow through units ensure air flow in downstream sections of unit has relatively uniform velocity profile.
- Supply fan guards to BS EN ISO 12100 and BS EN ISO 12499
- Accessories
  - Provide flexible connection between fan discharge and casing spigot. Ensure flexible connections comply with fire regulations.
  - Provide manometer connections to measure static pressure at fan inlet eye.

- Provide manometer connections to measure static pressure at fan discharge.

3042 HEAT RECOVERY EQUIPMENT:
- Run around coils
  - Units to be performance tested.
  - Provide slide rails to allow each coil section to be removed independently for access.
  - Fit internal baffle plates to prevent air from bypassing the coils.
  - Coils to be rated in accordance with BS EN 1216
- Plate heat exchanger
  - Units to be performance tested in accordance with BS EN 308 using the relevant testing protocol of Eurovent and shall be complete with by-pass (with a pressure drop across the by-pass the same as the heat exchanger).
- Thermal wheel
  - Units to be performance tested in accordance with BS EN 308 using the relevant testing protocol of Eurovent or AHRI Standard 1060. Units to be complete with a purge sector.
- Heat pipes
  - Units to be performance tested.
  - Refrigerant - R134A unless specified otherwise in the particular specification.

3050 DRAINAGE FROM AIR HANDLING UNIT COMPONENTS:
- Provide drainage pipework from cooling coils, humidifiers and components where water may collect. Comply with recommendations in CIBSE Technical Memorandum TM13 in connection with Legionnaires' disease and AHU manufacturers' installation recommendations.
- Material - glass drainage system unless specified otherwise in the particular specification.
- Pipe each trap to drain via a tun-dish or pipe each trap separately to discharge over a gully to prevent the potential of cross contamination between AHU's.
- Label each trap to state that it must be checked regularly / kept topped-up.
- Where freezing could occur insulate and trace-heat traps.

3060A CONTROL DAMPERS:
- Provide manufacturer's standard control dampers in accordance with DW/144.
- Provide motorized control dampers complete with extended spindle; motor; motor linkage; and motor support.

4040 DUCT CONNECTIONS:
- Ensure air is straightened as it leaves unit discharge. Ensure ductwork connection is long enough to ensure the aerodynamic performance of the fan is not affected.

4050 SERVICES CONNECTIONS:
- Ensure panels are sealed around electrical cable and pipework service entry points to prevent air leakage, using suitable and approved methods to suit individual services applications.
- Provide flexible cables between fan motor and local isolator.

4060 ISOLATION OF UNITS:
- Provide means of isolating air handling units electrically to allow maintenance and repairs to be carried out.
- Provide means of isolating pipework to air handling units to allow maintenance and repairs to be carried out.
- Provide means of isolating steam to humidifier when access door is opened.

4070 DRAINAGE OF FREE WATER:
- Make provision for free water to be caught, collected and drained away. Provide U-traps on all drains suitable for the negative/positive pressure created by the fan.

BS APPENDIX

BS 476-7:1997
Fire tests on building materials and structures. Part 7 Method of test to determine the classification of the surface spread of flame of products

BS 848-9:2007, ISO 13348:2007
Fans for general purposes. Tolerances, methods of conversion and technical data presentation.

BS EN 308:1997
Heat exchangers. Test procedures for establishing the performance of air to air and flue gases heat recovery devices

BS EN 1216:1999
Heat exchangers. Forced circulation air-cooling and air-heating coils. Test procedures for establishing the performance

BS EN 1886:2007
Ventilation for buildings. Air handling units. Mechanical performance

BS EN 13053:2006+A1:2011
Ventilation for buildings. Air handling units. Rating and performance for units, components and sections

BS EN ISO 5801:2017
Fans. Performance testing using standardized airways.

BS EN ISO 12100:2010
Safety of machinery. General principles for design. Risk assessment and risk reduction

BS EN ISO 12499:2008, BS 848-5:1999
Industrial fans. Mechanical safety of fans. Guarding

BS EN ISO 12759:2015
Fans. Efficiency classification for fans

Y41 FANS

1000 GENERAL:
- Standards
  - Provide fans manufactured and tested in accordance with appropriate British Standards.
  - With regard to safety requirements, comply with BS EN 60335-2-80 where applicable.
  - Fans for smoke and heat control to be in accordance with BS EN 12101-3
  - Fans for use in potentially explosive atmospheres / flameproof zones to be in accordance with BS EN 14986, relevant parts of BS EN ISO 80079, BS EN 13463 and BS EN IEC 60079/BS EN 60079, and be compliant with the ATEX directive.
  - Inline and chimney outlet exhaust fans to comply with BS EN 16475-2

1020 PROTECTION:
- Protect casings, impellers and shafts against corrosion.
- Protect bearings against dirt and moisture.

2010A NORMAL OPERATING CONDITIONS:
- Sound Power Level
  - Select fan, motor, drive and speed control system not to exceed fan sound power levels or sound pressure levels scheduled or specified elsewhere. Provide sound power data in accordance with BS EN ISO 5136, BS ISO 13347-1, BS ISO 13347-2, BS ISO 13347-3, BS ISO 13347-4.
- Air Density
  - Relate fan performance to air density 1.20kg/m^3.
- Temperature Range
  - Minimum to maximum operating temperatures -20°C to 60°C.

2020A CONSTRUCTION AND HANDLING:
- Casings
  - Construct rigid casing free from drumming under operating conditions. Supply in sections as required for access or handling. Flange dimensions in accordance with BS EN ISO 13351.
- Safety standards - to BS EN 60335-2-80.
- Rotating assemblies
  - Balance rotor in accordance with relevant parts of BS ISO 21940.
- Shafts and hubs
  - Machine impeller bosses and shafts to BS 4500 and key in accordance with BS 4235-1. Hold impeller to shaft with set screw or taper lock fitting.
- Shaft bearings - Sealed for life.
- Drives and guards
  - Provide guards over shaft, couplings and rope in accordance with BS EN ISO 12100 and Factory Inspectorate requirements.
- Material - galvanized or sheet steel.
- Lifting
  - Provide lifting eyebolts or similar facilities on fans or sections heavier than 20kg.

2030 TESTING:
- Provide results of aerodynamic performance tests in accordance with BS EN ISO 5801
- Provide results of sound power tests in accordance with BS ISO 13347-1, BS ISO 13347-2, BS ISO 13347-3, BS ISO 13347-4, and/or BS EN ISO 5136 as appropriate to the application.
- Provide fan vibration measurements in accordance with BS ISO 14695
- Provide balancing and vibration measurements in accordance with BS ISO 14695
- The minimum energy efficiency requirements for fans driven by electric motors with electric input between 125W and 500kW should comply with EC Regulation 327/2011.

2080C DOUBLE INLET DOUBLE WIDTH CENTRIFUGAL FANS:
- Fan impeller and casing aerodynamic efficiency
  - Manufacturer's standard to achieve overall efficiency of the fan, motor and drive combination scheduled or detailed elsewhere in the project particular specification.
- Operation - single.

- Impeller design
  - Supply fan with impeller to suit operating conditions.
- Casing - double inlet double width.
- Mounting - channel frame.
- Drain
  - Fit drain connection at lowest point of scroll unless indicated otherwise.

2110A ROOF MOUNTED SINGLE FANS:
- Fan impeller and casing aerodynamic efficiency
  - Manufacturer's standard to achieve overall efficiency of the fan, motor and drive combination scheduled or detailed elsewhere in the project particular specification.
- Operation - single.
- Vertical or horizontal discharge as shown on drawings.

2110B ROOF MOUNTED TWIN FANS:
- Fan impeller and casing aerodynamic efficiency
  - Manufacturer's standard to achieve overall efficiency of the fan, motor and drive combination scheduled or detailed elsewhere in the project particular specification.
- Operation - twin with automatic changeover.
- Vertical or horizontal discharge as shown on drawings.

3020 INSPECTION DOORS - CENTRIFUGAL FANS:
- Fit air-tight doors in scroll and cover.

3050A GUARDS:
- Provide guards in accordance with BS EN ISO 12100.
- Fit safety guards on air inlet and air outlet connections where these are freely accessible to personnel in accordance with BS EN ISO 12499.
- Provide bird guards where indicated.

3110 AIR FLOW SENSORS:
- Fit air flow sensors or pressure switches on twin fan units to sense fan failure and provide automatic changeover to standby fan.

4010 LOCATION:
- Install fans in positions indicated, in accordance with manufacturer's instructions and recommendations in CIBSE TM42 - Fan Application Guide.

4020 ATTITUDE:
- Mount impeller shaft horizontally unless otherwise indicated.

4030 ALIGNMENT:
- Ensure fan is installed aligned to allow optimum air flow path.

4040 TESTING:
- Ensure fan is isolated from installation during air leakage testing of ductwork.

4050 DRAIN CONNECTION:
- Fit trap to drain connection at lowest point of scroll on centrifugal fans where indicated.

BS APPENDIX

BS 4235-1:1972
Specification for metric keys and keyways. Part 1 Parallel and taper keys

BS 4500:2009
Limits and fits. Guidance for system of cone (taper) fits and tolerances for cones from C = 1:3 to 1:500, lengths from 6 mm to 630 mm and diameters up to 500 mm.

BS EN 12101-3:2015
Smoke and heat control systems. Specification for powered smoke and heat control ventilators (Fans)

BS EN 13463-2:2004
Non-electrical equipment for use in potentially explosive atmospheres. Protection by flow restricting enclosure "fr"

BS EN 13463-3:2005
Non-electrical equipment for use in potentially explosive atmospheres. Protection by flameproof enclosure 'd'

BS EN 14986:2017
Design of fans working in potentially explosive atmospheres

BS EN 16475-2:2017
Chimneys. Accessories. Chimney fans. Requirements and test methods

BS EN 60079-1:2014
Explosive atmospheres. Equipment protection by flameproof enclosures "d"

BS EN 60079-2:2014
Explosive atmosphere. Equipment protection by pressurized enclosure "p"

BS EN 60079-5:2015
Explosive atmospheres. Equipment protection by powder filling "q"

BS EN 60079-6:2015
Explosive atmospheres. Equipment protection by liquid immersion “o”

BS EN 60079-10-1:2015
Explosive atmospheres. Part 10-1 Classification of areas. Explosive gas atmospheres

BS EN 60079-10-2:2015
Explosive atmospheres. Classification of areas. Explosive dust atmospheres

BS EN 60079-11:2012
Explosive atmospheres. Part 11 Equipment protection by intrinsic safety "i"

BS EN 60079-13:2017
Explosive atmospheres. Equipment protection by pressurized room "p"

BS EN 60079-14:2014
Explosive atmospheres. Electrical installations design, selection and erection

BS EN 60079-15:2010
Explosive atmospheres. Part 15 Equipment protection by type of protection "n"

BS EN 60079-17:2014
Explosive atmospheres. Part 17 Electrical installations inspection and maintenance

BS EN 60079-18:2015+A1:2017
Explosive atmospheres. Equipment protection by encapsulation "m"

BS EN 60079-19:2011+A1:2015
Explosive atmospheres. Equipment repair, overhaul and reclamation

BS EN 60079-20-1:2010
Explosive atmospheres. Material characteristics for gas and vapour classification. Test methods and data

BS EN 60079-25:2010
Explosive atmospheres. Part 25 Intrinsically safe electrical systems

BS EN 60079-26:2015
Explosive atmospheres. Equipment with equipment protection level (EPL) Ga

BS EN 60079-27:2008
Explosive atmospheres. Fieldbus intrinsically safe concept (FISCO)

BS EN 60079-28:2015
Explosive atmospheres. Protection of equipment and transmission systems using optical radiation

BS EN 60079-29-1:2016
Explosive atmospheres. Gas detectors. Performance requirements of detectors for flammable gases

BS EN 60079-29-2:2015
Explosive atmospheres. Gas detectors. Selection, installation, use and maintenance of detectors for flammable gases and oxygen

BS EN 60079-29-3:2014
Explosive atmospheres. Gas detectors. Guidance on functional safety of fixed gas detection systems

BS EN 60079-29-4:2010
Explosive atmospheres. Gas detectors. Performance requirements of open path detectors for flammable gases

BS EN 60079-30-1:2017
Explosive atmospheres. Electrical resistance trace heating. General and testing requirements

BS EN 60079-30-2:2017
Explosive atmospheres. Part 30-2 Electric resistance trace heating. Application guide for design, installation and maintenance

BS EN 60079-31:2014
Explosive atmospheres. Equipment dust ignition protection by enclosure "t"

BS EN 60079-32-2:2015
Explosive atmospheres. Electrostatics hazards. Tests

BS EN 60079-35-1:2011
Explosive atmospheres. Caplights for use in mines susceptible to firedamp. General requirements. Construction and testing in relation to the risk of explosion

BS EN 60079-35-2:2012
Explosive atmospheres. Caplights for use in mines susceptible to firedamp. Performance and other safety-related matters

BS EN 60335-2-80:2003+A2:2009
Specification for safety of household and similar electrical appliances. Safety. Part 2-80 Particular requirements for fans

BS EN ISO 5136:2009
Acoustics. Determination of sound power radiated into a duct by fans and other air-moving devices. In-duct method

BS EN ISO 5801:2017
Fans. Performance testing using standardized airways.

BS EN ISO 12100:2010
Safety of machinery. General principles for design. Risk assessment and risk reduction

BS EN ISO 12499:2008, BS 848-5:1999
Industrial fans. Mechanical safety of fans. Guarding

BS EN ISO 13351:2009
Fans. Dimensions

BS EN ISO 80079-36:2016
Explosive atmospheres. Non-electrical equipment for explosive atmospheres. Basic method and requirements

BS EN ISO 80079-37:2016
Explosive atmospheres. Non-electrical equipment for explosive atmospheres. Non-electrical type of protection constructional safety "c", control of ignition sources "b", liquid immersion "k"

BS ISO 13347-1:2004+A1:2010
Industrial fans. Determination of fan sound power levels under standardized laboratory conditions. General overview

BS ISO 13347-2:2004
Industrial fans. Part 2 Determination of fan sound power levels under standardized laboratory conditions. Reverberant room method

BS ISO 13347-3:2004+A1:2010
Industrial fans. Part 3 Determination of fan sound power levels under standardized laboratory conditions. Enveloping surface methods

BS ISO 13347-4:2004
Industrial fans. Part 4 Determination of fan sound power levels under standardized laboratory conditions. Sound intensity method

BS ISO 14695:2003, BS 848-6:2003
Industrial fans. Method of measurement of fan vibration

BS ISO 21940-2:2017
Mechanical vibration. Rotor balancing. Vocabulary

BS ISO 21940-11:2016
Mechanical vibration. Rotor balancing. Procedures and tolerances for rotors with rigid behaviour

BS ISO 21940-12:2016
Mechanical vibration. Rotor balancing. Procedures and tolerances for rotors with flexible behaviour

BS ISO 21940-13:2012
Mechanical vibration. Rotor balancing. Criteria and safeguards for the insitu balancing of medium and large rotors

BS ISO 21940-14:2012
Mechanical vibration. Rotor balancing. Procedures for assessing balance errors

BS ISO 21940-21:2012
Mechanical vibration. Rotor balancing. Description and evaluation of balancing machines

BS ISO 21940-23:2012
Mechanical vibration. Rotor balancing. Enclosures and other protective measures for the measuring station of balancing machines

BS ISO 21940-31:2013
Mechanical vibration. Rotor balancing. Susceptibility and sensitivity of machines to unbalance

BS ISO 21940-32:2012
Mechanical vibration. Rotor balancing. Shaft and fitment key convention

Y42 AIR FILTRATION

1010 PRESSURE LOSS DATA:
- Provide pressure data as initial pressure loss at rated airflow and recommended final pressure loss.

1030 SEALS:
- Provide filters with edge seals as appropriate to prevent air by-passing. Ensure seals remain effective after removal and replacement of cells.

2040A PANEL FILTERS, CARDBOARD FRAME:
- Ensure filter media is retained in frame.
- Provide disposable filter media of glass fibre with scrim or composite fibre material.
- Filter frame - Water resistant cardboard.

2050A BAG FILTERS:
- Ensure media retains its shape during full air-flow conditions.
- Material
  - Provide synthetic or micro-fine glass fibre with reinforced backing mat.
  - Supply holding frame from material suitable for application complete with sealing gasket located in holding frame.

3010A PRESSURE GAUGE, DIAL TYPE:
- Dial type differential pressure gauge. Clearly mark gauge with positions equivalent to "Filter Dirty" and "Filter Clean" conditions.
- Connect gauge to duct mounting with PVC tubing. Fix external to unit to allow easy observation. Mount within 3m of filter.

3070A MOUNTING FRAMES:
- Where filter is mounted in walls or partitions, provide matching frames complete with building-in ties.

4010 LOCATION:
- Assemble filter in location indicated.

4020A ACCESS FOR MAINTENANCE:
- Provide access for changing filter media. Provide access for maintenance of motor drive and associated control equipment without disturbing filter media. Provide access for total duct maintenance.

Y43 COILS, HEAT RECOVERY EQUIPMENT AND GAS / ELECTRIC BATTERIES

2090 PLATE HEAT EXCHANGER:
- Units to be performance tested in accordance with BS EN 308 using the relevant testing protocol of Eurovent and shall be complete with bypass (with pressure drop across the bypass, the same as the heat exchanger).

3040 MOUNTING FRAME:
- On heating coils provide mounting frame for grouting into wall.

3050A AHU DUCT CONNECTIONS:
- To match air handling unit and specified method of assembly.

3050B EXTERNAL FLANGE DUCT CONNECTIONS:
- With external flanges drilled for bolting to counter flanges on adjacent plant or ductwork.

3050C INTERNAL FLANGE DUCT CONNECTIONS
- With internal flanges drilled for bolting to counter flanges on adjacent plant or ductwork.

3050D SPIGOT DUCT CONNECTIONS:
- With spigot duct connections.

4010 POSITION / LOCATION:
- Install coils, heater batteries and heat recovery equipment in air distribution system as indicated. Locate in positions where air velocity is substantially equal over face of approach duct.
- Arrange steam coils for horizontal air flow.
- Ensure equipment, controls and instruments positioned adjacent to heating coils, heater batteries and heat recovery equipment are not adversely affected by thermal radiation.

4020B HEATING COIL CONNECTIONS:
- Arrange pipe connections to take up thermal expansion movement without imposing stress on coil.

4040 PROTECTION:
- Protect coils, heater batteries and heat recovery equipment from damage and ingress of dirt during the course of contract. Restore fins and other parts of coils, heater batteries and heat recovery equipment to original condition if any damage has occurred. Ensure all connected ductwork is thoroughly clean before removing protection and passing air through system.

4050 EQUIPMENT INSTALLATION:
- Install equipment in accordance with manufacturer's recommendations.
- Ensure maintenance requirements are incorporated.

BS APPENDIX

BS 1872:1984
Specification for electroplated coatings of tin

BS 5141-1:1975
Specification for air heating and cooling coils. Part 1 Method of testing for rating of cooling coils

BS 5141-2:1977
Specification for air heating and cooling coils. Part 2 Method of testing for rating of heating coils

BS EN 308:1997
Heat exchangers. Test procedures for establishing the performance of air to air and flue gases heat recovery devices

BS EN 1057:2006+A1:2010
Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating

applications

BS EN 1216:1999
Heat exchangers. Forced circulation air-cooling and air-heating coils. Test procedures for establishing the performance

BS EN 10143:2006
Continuously hot-dip coated steel sheet and strip. Tolerances on dimensions and shape

BS EN 10216-5:2013
Seamless steel tubes for pressure purposes. Technical delivery conditions. Part 5 Stainless steel tubes

BS EN 10255:2004
Non-alloy steel tubes suitable for welding and threading. Technical delivery conditions

BS EN 10346:2015
Continuously hot-dip coated steel flat products for cold forming. Technical delivery conditions

BS EN 12449:2016
Copper and copper alloys. Seamless, round tubes for general purposes

BS EN 12450:2012 :
Copper and copper alloys. Seamless, round copper capillary tubes

BS EN 12451:2012
Copper and copper alloys. Seamless, round tubes for heat exchangers

BS EN 12452:2012
Copper and copper alloys. Rolled, finned, seamless tubes for heat exchangers

BS EN ISO 1461:2009
Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods

Y45 SILENCERS / ACOUSTIC TREATMENT

1010 PERFORMANCE:
- Ensure that specified performance is met where protection is applied to infill to protect from moisture and grease.

1020 TESTING:
- Provide certified insertion loss data in accordance with BS EN ISO 7235.

Provide generated sound power levels with insertion loss data.

1030 PROTECTION:
- Protect silencers where they are installed in positions exposed to external weather conditions.
- Block ends of silencers prior to delivery to site to prevent damage.

1040 DIRECTION OF FLOW:
- Clearly mark direction of air flow on silencers.

2010A FIRE PROPERTIES, BS 476-7, CLASS 1:
- Use non-flammable adhesives. Ensure that all insulating materials and coverings are non-combustible material covered with a material that complies with flame spread requirements of BS 476-7, Class 1.

2010B FIRE PROPERTIES, BUILDING REGULATIONS, CLASS O:
- Use non-flammable adhesives. Ensure that all insulating materials and coverings are to Class O surface rating of Building Regulations.

2020A CIRCULAR SILENCERS - CASING TO DW144 WITH EXTERNAL FLANGES:
- Provide circular silencers compatible with ductwork installation. Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Construct casing to DW/144 with external flanges drilled for bolting to counter flanges on adjacent plant or ductwork.

2020B CIRCULAR SILENCERS - CASING TO DW144 WITH INTERNAL FLANGES:
- Provide circular silencers compatible with ductwork installation. Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Construct casing to DW/144 with internal flanges drilled and threaded for bolting to counter flanges on adjacent plant or ductwork.

2020C CIRCULAR SILENCERS - CASING TO DW144 WITH SPIGOT ENDS:
- Provide circular silencers compatible with ductwork installation. Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Construct casing to DW/144 with plain spigot ends for connection to adjacent plant or ductwork.

2040A RECTANGULAR SILENCERS - CASING TO DW144 WITH CONNECTIONS TO MATCH AHU:
- Provide rectangular silencers compatible with ductwork installation. Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Construct splitters with manufacturer's standard ends.
- Construct casing to DW/144 with duct connections to match the air handling unit and specified method of assembly.

2040B RECTANGULAR SILENCERS - CASING TO DW144 WITH EXTERNAL FLANGES:
- Provide rectangular silencers compatible with ductwork installation. Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Construct splitters with manufacturer's standard ends.
- Construct casing to DW/144 with external flanges drilled for bolting to counter flanges on adjacent plant or ductwork.

2040C RECTANGULAR SILENCERS - CASING TO DW144 WITH INTERNAL FLANGES:
- Provide rectangular silencers compatible with ductwork installation.

- Provide infill that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Construct splitters with manufacturer's standard ends.
- Construct casing to DW/144 with internal flanges drilled and threaded for bolting to counter flanges on adjacent plant or ductwork.

2070A AIR TRANSFER/CROSS TALK ATTENUATORS - EXTERNAL FLANGES:
- Provide attenuators for air transfer and cross talk applications. Provide lining that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Construct casing with lock-formed longitudinal joints, mastic sealed.
- Provide external flanges drilled for bolting to counter flanges on adjacent ductwork.
- Fixing
  - Interface with building components as indicated.

2070B AIR TRANSFER/CROSS TALK ATTENUATORS - INTERNAL FLANGES:
- Provide attenuators for air transfer and cross talk applications. Provide lining that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Construct casing with lock-formed longitudinal joints, mastic sealed.
- Provide internal flanges drilled and threaded for bolting to counter flanges on adjacent ductwork.
- Fixing
  - Interface with building components as indicated.

2070C AIR TRANSFER/CROSS TALK ATTENUATORS - SPIGOT ENDS:
- Provide attenuators for air transfer and cross talk applications. Provide lining that is inert, fire proof, inorganic, vermin proof, non-hygroscopic.
- Construct casing with lock-formed longitudinal joints, mastic sealed.
- Provide plain spigot ends for connection to adjacent ductwork.
- Fixing
  - Interface with building components as indicated.

2120B ACOUSTIC LOUVRES WITH INFILL:
- Performance
  - Provide certified acoustic performance data measured in accordance with BS EN ISO 10140.
  - Ensure louvre withstands specified wind loads and prevent ingress of rain.
- Construction
  - Construct louvre frame and aerodynamically profiled louvre blades from galvanized mild steel or aluminium as appropriate. Provide integral drainage channels.
  - Provide acoustic infill which is inert, fire proof, inorganic, vermin proof and non-hydroscopic.
  - Retain infill on louvre blades by perforated sheet of galvanized mild steel or aluminium as appropriate.
  - Acoustic infill to be wrapped with woven glass scrim cloth or 'Melinex' to prevent migration of particles into the airflow / protect the infill. Full account of the reduction in performance of the acoustic louvre brought about by the addition of the infill protection shall be made when selecting silencers to meet the required performances.
- Screen
  - Fit a bird-screen using mesh no coarser than 12mm, across inside face of louvres.
- Quality assurance
  - Ensure manufacturers are a firm of Assessed Capability to BS EN ISO 9001 and produce louvre to relevant Quality Assessment schedule.

3040 SUPPORTS:
- Supply steel section supporting frames or brackets where silencers are fixed to the walls of air chambers.

3060 SOUND PRESSURE LEVEL READINGS:
- Measure sound pressure levels at the positions indicated using equipment in accordance with BS EN 61672-1 and BS EN 61672-2.

BS APPENDIX

BS 476-7:1997
Fire tests on building materials and structures. Part 7 Method of test to determine the classification of the surface spread of flame of products

BS EN 61672-1:2003
Electroacoustics - sound level meters. Part 1 Specification

BS EN 61672-2:2003
Electroacoustics - sound level meters. Part 2 Pattern evaluation tests

BS EN ISO 7235:2003
Acoustics. Laboratory measurement procedures for ducted silencers and air-terminal units. Insertion loss, flow noise and total pressure loss

BS EN ISO 9001:2015
Quality management systems. Requirements

BS EN ISO 10140-1:2016
Acoustics. Laboratory measurement of sound insulation of building elements. Part 1 Application rules for specific products

BS EN ISO 10140-2:2010
Acoustics. Laboratory measurement of sound insulation of building elements. Part 2 Measurement of airborne sound insulation

BS EN ISO 10140-3:2010+A1:2015
Acoustics. Laboratory measurement of sound insulation of building elements. Part 3 Measurement of impact sound insulation

BS EN ISO 10140-4:2010
Acoustics. Laboratory measurement of sound insulation of building elements. Part 4 Measurement procedures and requirements

BS EN ISO 10140-5:2010+A1:2014
Acoustics. Laboratory measurement of sound insulation of building elements. Part 5 Requirements for test facilities and equipment

Y46 GRILLES / DIFFUSERS / LOUVRES

1010 PERFORMANCE:
- Maximum mean air velocity in the occupied zone in summer and winter shall not exceed the criteria for a category B thermal environment as defined in BS EN ISO 7730 (PPD<10%) table A.5. unless specified otherwise elsewhere in this specification.
- Blades - Supply grilles and diffusers with blade profile to ensure correct aerodynamic performance and minimal noise generation.
- Louvres - Ensure air velocities through face area of louvres minimises 'carry-over' of rain, snow or other precipitation into ducts, shafts or plant rooms and ensure louvres are tested in accordance with BS EN 13030 and are subject of on-going factory production control auditing. Performance classes to BS EN 13030 are given elsewhere in this specification.

1020 SIZE:
- Sizes indicated are 'Nominal'.
- Provide size dimensions of linear diffusers and grilles before manufacture.

1030 NOISE LEVELS:
- Ensure sound power levels indicated are not exceeded. Ensure accessories for grilles and diffusers have low noise generation characteristics, and cause minimum disturbance to airflow.

1033 PROTECTIVE WRAPPING:
- Apply protective wrapping to exposed architectural finishes prior to despatch to site.

1040 ELECTRICAL BONDING TERMINAL:
- Ensure an electrical bonding terminal suitable for connection of $6mm^2$ maximum conductor is provided on metal grilles, diffusers and louvres where indicated.

2010A GRILLES - FIXED BLADE TYPE:
- Secure blades within flanged mounting frame or core collar. Provide support mullions to ensure blade stability.
- Style, blade rows and air pattern control as indicated on schedule.

2020A GRILLES - ADJUSTABLE BLADE TYPE:
- Pivot blades within flanged mounting frame and retain blades in set position by tensioners external to the air stream.
- Provide blade rows and blade angle adjustment as indicated on schedule.

2030A GRILLES - MESH TYPE:
- Core material - Cellular, expanded or perforated as indicated on schedule.
- Frame - Flange mounting frame or plate flange as indicated on schedule.
- Fixing - Permanently fixed or designed for easy removal, as indicated.

2040A GRILLES - EGG-CRATE TYPE:
- Core material - Aluminium or plastic as indicated.
- Style - Flanged or channel frame; or core only as indicated.

2050A GRILLES - LINEAR TYPE:
- Supply linear type grilles with one row of parallel blades. Secure blades within mounting frame or opening. Permanently set at angle indicated.

2070A TRANSFER GRILLES - SIGHTPROOF NON-VISION TYPE:
- Supply sightproof non-vision grilles with one set of blades at centres indicated.
- Fix within a flanged mounting frame or a core box as indicated.

2070B TRANSFER GRILLES - LIGHTPROOF NON-VISION TYPE:
- Supply lightproof non-vision grilles with two sets of blades at centres indicated.
- Fix within a flanged mounting frame or a core box as indicated.

2070C TRANSFER GRILLES - FIRE RESISTANT NON-VISION TYPE
- Supply grilles comprising Zintec steel frame with an intumescent core and two steel grilles, colour as indicated or scheduled.
- Comply with the requirements of BS 9999.
- Fire resistance tests for wall, ceiling or floor mounting types in accordance with BS EN 1364-5 or BS 476-22.
- Fire resistance tests for door mounting types in accordance with BS 476-22.
- Fix as indicated in accordance with the manufacturer's recommendations.

2070D TRANSFER GRILLES - FIRE RESISTANT NON-VISION TYPE WITH SMOKE CONTROL FACILITY:
- Supply grille assembly comprising Zintec steel frame with an intumescent core with damper and actuator assembly to automatically close in the event of an alarm, power failure or damage to wiring. Units to be complete with steel cover grilles, colour as indicated or scheduled.
- Comply with the requirements of BS 9999.
- Fire resistance tests for door mounting types in accordance with BS 476-20 and BS 476-22.
- Smoke leakage tests for smoke shutter type through door sets to be in accordance with BS 476-31.1.
- Fix as indicated in accordance with the manufacturer's recommendations.

2080A CONE TYPE CIRCULAR DIFFUSERS:
- Supply circular diffusers manufactured to ensure rigid and smooth outer cone or frame, and inner assembly.
- Space all cones to ensure even distribution of air flow with minimum resistance and noise, and to allow easy cleaning.
- Cone type - Fixed or adjustable deflection cone type as indicated.

2080B PAN TYPE CIRCULAR DIFFUSERS:
- Supply circular diffusers manufactured to ensure rigid and smooth outer cone or frame, and inner assembly.
- Pan type - Fixed or adjustable pan type as indicated.

2080C CIRCULAR DIFFUSERS - CORE ADJUSTMENT:
- Provide core adjustment to obtain required air distribution pattern. Allow inner assembly to move vertically by vertical sliding action or rotation as indicated.

2090A DIFFUSERS - LINEAR TYPE:
- Supply single unit or continuous length linear diffusers manufactured with one or more rigid and smooth line slot units with parallel bars and partitions.
- Fit closing caps at ends of single or multiple continuous length units.
- Provide continuous lengths complete with locating pins or strips with keys to ensure correct alignment of abutted ends.
- Air Controller - Fit each slot with device indicated.

2100 DIFFUSERS - PERFORATED FACE TYPE:
- Supply perforated face diffusers with rigid and smooth inlet spigot expanded to butt and seal against easily removable framed perforated front panel. Incorporate back deflectors above front panel, set to give required performance.
- Supply type and profile of framed perforated front panel to mount flush with surrounding false ceiling panels.

2110A ADJUSTABLE CURVED BLADE DIFFUSER:
- Supply diffusers manufactured from curved cross sectional profile parallel blades pivoted at each end within flanged mounting frame. Ensure that each blade is individually adjustable to give directional control of air stream. Retain blades in set position by tensioners external to air stream.
- Control ways as indicated on drawings.

2120A ADJUSTABLE CURVED BLADE DIFFUSER WITH REMOVABLE INNER CORE:

- Supply diffusers manufactured from curved cross sectional profile parallel blades within removable core frame and include integral multi-blade volume control at each blade set. Ensure assembly is removable from flanged mounting frame. Make provision for volume control adjustment by loose key.
- Ensure that each blade within core is individually adjustable, and that each core is designed to give directional control of air stream through each 90° angle.
- Control ways as indicated on drawings.

2130A STRAIGHT LINE, FIXED LOUVRE DIFFUSER WITH FIXED CORE:
- Supply diffusers manufactured from louvre type parallel blades permanently set and securely fixed within frame.
- Pre-set each blade to give directional control of air stream.
- Control ways as indicated on drawings.

2130B STRAIGHT LINE, FIXED LOUVRE DIFFUSER WITH REMOVABLE CORE:
- Supply diffusers manufactured from louvre type parallel blades permanently set and securely fixed within frame.
- Supply core frames which are easily removable from flanged mounting frame.
- Pre-set each blade to give directional control of air stream.
- Control ways as indicated on drawings.

2180 DIFFUSERS - EXTRACT/EXHAUST VALVE TYPE:
- Supply diffusers incorporating intake ring and adjustable valve disc assembly. Provide bayonet type fixing for purpose made mounting ring with plastic foam sealing gasket. Provide setting template.
- Adjust valve to required setting and lock valve in required position.

2190A LOUVRES - EXTERNAL AIR SUPPLY/EXTRACT TYPE:
- Provide louvres which have been tested in accordance with BS EN 13030, and which are the subject of ongoing factory production control auditing.
- Performance and classification to BS EN 13030
  - Ensure louvres perform to water penetration class as scheduled.
  - Ensure louvres achieve the required coefficient of discharge class at the limiting core velocity as scheduled.
- Construction - Construct louvre frame and aerodynamically profiled louvre blades from galvanized mild steel or aluminium as indicated.
  - Provide integral drainage channels.
  - Retain infill on louvre blades by perforated sheet of galvanized mild steel or aluminium as indicated.
- Screen - Fit a bird-screen using mesh no coarser than 12mm, across inside face of louvres.
- Quality assurance - Ensure manufacturers are a firm of Assessed Capability to BS EN ISO 9001 and produce louvre to relevant Quality Assessment schedule.

2200 LOUVRES/SCREEN WALLING:
- Provide louvres which have been tested in accordance with BS EN 13030, and which are the subject of ongoing factory production control auditing.
- Performance and classification to BS EN 13030
  - Ensure louvres perform to water penetration class as scheduled.
  - Ensure louvres achieve the required coefficient of discharge class at the limiting core velocity as scheduled.
- Construct with mullions into which blades are fitted and provide blades with aerodynamic profiles and integral drainage channels. Mount assembly within frame. Ensure louvre system is integrated with weather louvres and incorporates doors with concealed hinges and frames where indicated. Where necessary provide mitred corners and slope louvres.
- Ensure adequate space for access and maintenance of louvres and associated equipment is provided.
- Where indicated ensure manufacturers are a firm of Assessed Capability to BS EN ISO 9001 and produce louvre to relevant Quality Assessment schedule.
- Installation - Install louvres strictly in accordance with the manufacturer's instructions.

2220A GRILLE AND DIFFUSER CONSTRUCTION:
- Ensure grilles and diffusers are robust and mounting frame flanges on square and rectangular terminals have mitred corners. Fit a rubber or plastic foam sealing strip or gasket to rear face of flange.
- Diffusers - Ensure face of diffuser outer cone or frame is completely smooth.

2230A LOUVRE CONSTRUCTION:
- Ensure louvres are robust. Incorporate in purpose made sub-frame. Provide drip sills as indicated.

3010A OPPOSED BLADE VOLUME CONTROL DAMPERS - LOCAL CONTROL:
- Balance and tension operating mechanisms to give positive setting for blade positions from fully open to fully closed.
- Local blade operation
  - Supply device for operating damper blades through face or side of grille/diffuser as indicated.

3010B OPPOSED BLADE VOLUME CONTROL DAMPERS - REMOTE CONTROL:
- Balance and tension operating mechanisms to give positive setting for blade positions from fully open to fully closed.
- Remote blade operation.
  - Supply remote control with necessary brackets and linkage at control unit.

3030A ANNULAR RING VOLUME CONTROL DAMPERS:
- Provide manual operation by loose key.

3040A BUTTERFLY VOLUME CONTROL DAMPERS:
- Operate via a simple hooked wire key connecting with a lug on the underside of each plate; or by a loose key locating into a control mechanism.

3050A "IRIS" VOLUME CONTROL DAMPERS:
- When in fully open setting ensure that unit inside diameter is equal to full internal diameter of air diffuser spigot, or ducting branch connection. Method of operation as indicated on the schedule.

3060A FIXED AIR FLOW DEFLECTORS:
- Direct air stream evenly from main ducting into branches or spigots serving air grilles and diffusers by using a number of equally spaced curved blades linked together.

3060B ADJUSTABLE AIR FLOW DEFLECTORS:
- Direct air stream evenly from main ducting into branches or spigots serving air grilles and diffusers by using a number of equally spaced curved blades linked together.

3070 BLANKING PLATES:
- Supply blanking plates to restrict projection of air flow from a particular section of grille or diffuser. Ensure that indicated dimensions or angles in degrees are maintained.

3080 PERFORATED BAFFLE PLATES:
- Cover full width or depth of plenum box and extend beyond each side of air inlet to ensure even air distribution.
- Position centrally relative to plenum box air inlet.

3090 PERFORATED SCREENS:
- Fit perforated screens behind grille volume control devices to equalize air flow and pressure. Contain perforated sheet within rigid surrounding frame, incorporating fixing brackets or lugs.

3100 CEILING OR WALL-MOUNTED PLENUM BOXES:
- Supply single plenum box or series of plenum boxes butted together to form continuous length, where indicated. Ensure sturdy and rigid construction with circular inlet spigots 65mm minimum length.
- Incorporate at least four drilled angle brackets, or flat bar lugs, for securing to, or suspension by rods or wires from building or other construction.

3120A HINGED LOUVRE ACCESS PANELS AND DOORS:

- Incorporate purpose made access panels or doors within body of louvres, manufactured from compatible materials.
- Use hinged access panels or doors of single or double style and with front or rear locking facilities.

3120B LIFT OUT LOUVRE ACCESS PANELS AND DOORS:
- Incorporate purpose made access panels or doors within body of louvres, manufactured from compatible materials.
- Use permanent housed or lockable lift out access panels.

3130 SPARES:
- Supply indicated number of loose keys, suitable for adjusting each size and type of grille, or operating accessories.

3140A OPPOSED BLADE VOLUME CONTROL DAMPERS - LOCAL BLADE OPERATION:
- Balance and tension operating mechanisms to give positive setting for blade positions from fully open to fully closed.
- Local blade operation
  - Supply device for operating damper blades through face or side of grille/diffuser as indicated.

3150A BUTTERFLY VOLUME CONTROL DAMPERS:
- Operate via a simple hooked wire key connecting with a lug on the underside of each plate, or by a loose key locating into a control mechanism.

3160A "IRIS" VOLUME CONTROL DAMPERS:
- When in fully open setting ensure that unit inside diameter is equal to full internal diameter of air diffuser spigot, or ducting branch connection. Method of operation as indicated on the schedule.

4010 GRILLE/DIFFUSER LOCATION:
- Fit at terminal air supply, extract and transfer points indicated, in accordance with the HEVAC Air Diffusion Guide.

4040 CONNECTION TO DUCTWORK:
- When connecting directly to duct spigot, secure grille mounting frame or flange with screws, or bolts and nuts, to returned flange, with filled in corners, at end of duct spigot.

4050A INSTALLATION IN BUILDERS WORK:
- Ensure outer edge of grille mounting frame or flange extends on all sides beyond the joint between any builders work frame and surrounding building construction.
- Ensure grilles are sealed to building fabric - including ceilings, to prevent air leakage from pressurised rooms to voids above.
- Fix louvres to building fabric using method indicated on drawings.

4060A TRANSFER GRILLES:
- Where transfer points are located in partitions or walls, prevent through vision by fitting a fixed blade grille on both faces of partition or wall. Connect cavity wall or partition transfer grille assemblies with ducting sleeve or collar extending between grilles.

4060B TRANSFER GRILLES WITH FIRE DAMPER:
- Where transfer points are located in partitions or walls, prevent through vision by fitting a fixed blade grille on both faces of partition or wall. Connect cavity wall or partition transfer grille assemblies with ducting sleeve or collar extending between grilles.
- Incorporate fire damper in fire compartment wall transfer grille assembly.
- Comply with the manufacturer's installation instructions.

BS APPENDIX

BS 476-20:1987
Fire tests on building materials and structures. Part 20 Method for determination of the fire resistance of elements of construction (general principles)

BS 476-22:1987
Fire tests on building materials and structures. Part 22 Method for determination of the fire resistance of non-loadbearing elements of construction

BS 476-31.1:1983
Fire tests on building materials and structures. Part 31.1 Methods for measuring smoke penetration through doorsets and shutter assemblies. Method of measurement under ambient temperature conditions

BS 9999:2017
Fire safety in the design, management and use of buildings. Code of practice

BS EN 1364-5:2017
Fire resistance tests for non-loadbearing elements. Air transfer grilles

BS EN 13030:2001
Ventilation for buildings. Terminals. Performance testing of louvres subjected to simulated rain

BS EN ISO 7730:2005
Ergonomics of the thermal environment. Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria

BS EN ISO 9001:2015
Quality management systems. Requirements

Y50 THERMAL INSULATION

1010 TEMPERATURE RANGE:
- Refer to insulation manufacturer's recommendations to determine suitability of different insulation materials at different temperature ranges.

1020 STANDARDS:
- Comply in general with
  - BS 5422
  - BS 5970
  - BS EN ISO 12241
- For product clauses comply with
  - BS EN 14303
  - BS EN 14304
  - BS EN 14314
- Use the description of terms as BS 3533.
- All insulation products must have a Declaration of Performance (DoP) certificate and be CE marked in accordance with the Construction Products Regulations 2013 (CPR).
- Comply with BS EN 16783 and BS EN 15804 in preparing environmental product declarations (EPD's)

1035A EUROPEAN CLASSIFICATION FOR REACTION TO FIRE PERFORMANCE:
- Supply insulating materials classified in accordance with BS EN 13501-1. Classes acceptable are $A1/A1_L$, $A2/A2_L$ or B/B_L having smoke emission classification of s1 and production of flaming droplets/particles classification of d0.
- Test methods
  - BS EN ISO 1182, BS EN ISO 1716, BS EN 11925-2, BS EN 13823 as appropriate.

1050A SPREAD OF FLAME:
- When completed, ensure surface-finish complies with BS 476-7 Class 1 spread of flame.

1055 SMOKE EMISSION CHARACTERISTICS:
- Ensure only products classified by BS EN 13501-1 as s1 (materials that give off little or no smoke) are used.

1080 ELECTRICAL BONDING TERMINAL:
- Ensure an electrical bonding terminal suitable for connection of $6mm^2$ maximum conductor is provided where indicated.

1090 INSPECTION AND TESTING:
- Arrange performance test of thermal conductivity on materials selected, carried out at manufacturer's works or at an approved laboratory and in accordance with appropriate British Standard.
- Provide assistance to allow for inspection of all sizes of insulation on all services after installation to determine thickness and compliance with specification. Make good any sections that are cut during inspection for thickness and compliance with specification.

2010 THERMAL CONDUCTIVITY:
- All thermal conductivity figures given in insulation product clauses are typical values at the mean temperature stated, as declared in manufacturer's Declaration of Performance (DoP) certificates in accordance with the CPR.

2015A THERMAL PERFORMANCE LIFE EXPECTANCY FOR PLANT DESIGN LIFE:
- Ensure the insulation will maintain it's thermal performance for a minimum of the plant design life.

2015B THERMAL PERFORMANCE LIFE EXPECTANCY DETAILS:
- Provide manufacturer's details which define the life expectancy of the insulation material. Where appropriate this shall include both 'as manufactured' and 'aged' thermal conductivity values in accordance with BS EN 14314.

2020 RESTRICTIONS ON USE OF MATERIALS:
- Protect insulated stainless steel surfaces from the risk of stress corrosion in accordance with the recommendations in BS 5970.
- For all mineral wool insulation products, test evidence must be available showing that the fibres from which the products are made are not classified as a possible human carcinogen, as detailed by European Directive 97/69/EC and the Approved Supply List of CHIP98, and that the fibres should be bio-soluble.

2030A FOIL FACED ROCK MINERAL WOOL PIPE INSULATION:
- Standard - BS EN 14303.
- Nominal density - 120 kg/m^3.
- Thickness - 20mm to 100mm.
- Thermal conductivity - Typical value 0.033 - 0.034 W/mK at a mean temperature of 10°C.
- Finish - Reinforced aluminium foil with at least 25mm overlap.

2060A FOIL FACED ROCK MINERAL WOOL LAMELLA DUCT INSULATION:
- Standard - BS EN 14303
- Nominal density - 24-45 kg/m^3.
- Thickness - 25mm to 80mm.
- Thermal conductivity - Typical value of 0.04 W/mK at a mean temperature of 10°C.
- Finish - Reinforced aluminium foil.

2080A FLAT DUCTWORK FIRE PROTECTION INSULATION - MITRED JOINTS:
- Material - Mineral wool, slab for flat ducts, with 45° mitred joints.
- Nominal density - 165 kg/m^3.
- Thermal conductivity - Typical value of 0.035 W/mK at a mean temperature of 10°C.
- Facing - Reinforced aluminium foil.

2080B FLAT DUCTWORK FIRE PROTECTION INSULATION - BUTTED JOINTS:
- Material - Mineral wool, slab for flat ducts, with 90° butted joints.
- Nominal density - 165 kg/m^3.
- Thermal conductivity - Typical value of 0.035 W/mK at a mean temperature of 10°C.
- Facing - Reinforced aluminium foil.

2080C CIRCULAR DUCTWORK FIRE PROTECTION INSULATION - SECTION:
- Material - Mineral wool
  - Section for circular duct, 17 to 610 mm diameter.
- Nominal density - 165 kg/m^3.
- Thermal conductivity - Typical value of 0.035 W/mK at a mean temperature of 10°C.
- Facing - Reinforced aluminium foil.

2080D CIRCULAR DUCTWORK FIRE PROTECTION INSULATION - PSM:
- Material - Mineral wool
  - PSM for circular duct greater than 406mm diameter.
- Nominal density - 165 kg/m^3.
- Thermal conductivity - Typical value of 0.035 W/mK at a mean temperature of 10°C.
- Facing - Reinforced aluminium foil.

2080E CIRCULAR DUCTWORK FIRE PROTECTION INSULATION - FLEXIBLE MAT:
- Material - Mineral wool wire faced flexible mattress.
- Nominal density - 66 kg/m^3.
- Thermal conductivity - Typical value of 0.035 W/mK at a mean temperature of 10°C.
- Facing - Reinforced aluminium foil.

2180A BITUMEN VAPOUR BARRIER COATINGS:
- Cut-back bitumens with cotton canvas or open mesh glass cloth to reinforce coatings.

2180B VINYL VAPOUR BARRIER COATINGS:
• Vinyl emulsions with cotton canvas or open mesh glass cloth to reinforce coatings.

2180C SOLVENT POLYMER VAPOUR BARRIER COATINGS:
• Solvent-based polymers with cotton canvas or open mesh glass cloth to reinforce coatings.

2180D BITUMEN EMULSION VAPOUR BARRIER COATINGS:
• Bitumen emulsions (with or without elastomer latex) with cotton canvas or open mesh glass cloth to reinforce coatings.

2190 ADHESIVES:
• Comply with the recommendations of clause 10.1 of BS 5970, for insulation bonding adhesives, lagging adhesives; and facing and film attachment adhesives.

2200E ALUMINIUM SHEETING PROTECTION:
• Apply flat (embossed) or profiled aluminium cladding directly to insulating material. 0.56mm thick on pipework; 0.71mm thick on ductwork.

2220A VALVE AND FLANGE INSULATION - ALUMINIUM CASING:
• Install insulation on flanges and valves.
• Use a protected metal split casing fabricated from 0.91mm aluminium sheet fitted with spring clip fasteners, filled with insulating material with same thermal performance as insulation on adjoining pipe.

2286 CALCULATION OF INSULATION THICKNESS - BUILDING REGULATIONS :
• Provide insulation of thickness conforming with the requirements of the Building Regulations (England and Wales) Part L Approved Documents or the Scottish Technical Handbooks, and the calculation methods given in BS EN ISO 12241 using the standardised assumptions within BS 5422 .

2289 INSULATION THICKNESS TABLES:
• Unless stated otherwise the thicknesses given in the tables in this specification are the nearest commercially available material thickness to meet the minimum calculated thickness to BS EN ISO 12241 and the product declared performance data for CE marking. Thicknesses have been calculated by manufacturers for each product and use thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures listed in the relevant tables.
• Should alternative products be offered that may have different performance data the Contractor shall ensure the manufacturer undertakes calculations and submits appropriate thickness table.
• Unless specified otherwise elsewhere, the thicknesses for pipe of greater diameter, flat surfaces or irregular shaped plant items shall not be less than that for the largest pipe size given in the thickness tables.

2290 NON-DOMESTIC HOT WATER SERVICE INSTALLATIONS - BUILDING REGULATIONS ROCK MINERAL WOOL:
• Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide, Northern Ireland Technical Booklet F2 and Section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of rock mineral wool (mm)	
Surface emissivity	0.05	0.9
17	25	30
21	25	30
27	30	35
34	30	35
42	30	35
48	35	40
60	40	40
76	35	45

89	35	45
114	40	45
140	40	45
168	40	50
219	40	50
273 and above	45	50

- Basis: Horizontal pipe at 60°C in still air at 15°C, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
- Use this table for insulation thickness of copper pipework of the nearest equivalent outside diameter.
- Use this table for insulation thickness of plastic pipework of the nearest equivalent outside diameter.

2310 NON-DOMESTIC HEATING INSTALLATIONS, BUILDING REGULATIONS - ROCK MINERAL WOOL:

- Insulation thickness to achieve the maximum permissible heat loss stated in the Building Regulations Part L Non Domestic Building Services Compliance Guide Northern Ireland Technical Booklet F2, and section 6 of the Scottish Non Domestic Technical Handbook.

Outside diameter of steel pipe (mm)	Thickness of rock mineral wool insulation (mm)					
Temperature of contents °C	≤95		96-120		121-150	
Surface emissivity	0.05	0.9	0.05	0.9	0.05	0.9
17	25	30	25	30	25	30
21	30	35	30	35	30	35
27	35	40	40	45	40	45
34	35	40	45	55	55	55
42	35	40	55	60	65	70
48	40	45	55	60	70	75
60	40	45	60	65	75	80
76	45	50	60	65	80	90
89	45	50	65	70	80	90
114	50	55	65	75	90	100
140	50	55	70	75	90	100
168	50	55	70	80	100	100
219	50	60	75	80	100	120
273	50	60	75	90	100	120

- Basis of calculation of thickness: Horizontal pipe at 75°C (LTHW) or 100°C (MTHW) or 125°C (HTHW) in still air at 15°C. Thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- Use this table for insulation thickness of copper or plastic pipework of the nearest equivalent outside diameter.

2327 NON-DOMESTIC HEATING INSTALLATIONS, ECA ENHANCED:

- The insulation manufacturer selected for a particular project should calculate the minimum required thicknesses of pipework insulation based on the actual conductivity of the product at the relevant temperature and the criteria on the ECA web site for an eligible installation using the methodology set out in BS EN ISO 12241 and the assumptions set out in Table C1 of BS 5422. The table below defines the maximum permissible heat losses to be used in the calculations.

Non-Domestic Heating Installations Maximum Permitted Heat Loss (W/m)			
Temperature	Low	Medium	High
	< 95°C	96-120°C	121-150°C
Outside Pipe Diameter (mm)			
17.2	7.78	10.57	13.27

21.3	8.42	11.25	14.06
26.9	9.05	12.06	15.02
33.7	9.86	13.04	16.07
42.4	10.83	14.12	17.34
48.3	11.42	14.80	18.09
60.3	12.61	16.22	19.62
76.1	14.12	17.88	21.41
88.9	15.28	19.20	22.87
114.3	17.51	21.66	25.53
139.7	19.72	23.99	27.98
168.3	22.34	26.63	30.69
219.1	26.61	31.15	35.25
273 & above	30.91	35.83	40.05

2420 PROTECTION AGAINST FREEZING - ROCK MINERAL WOOL:

Outside diameter of pipe (mm)	Indoor condition where freezing might occur	Outdoor condition where freezing might occur
	Thickness of mineral wool insulation (mm)	
Copper		
15	-	-
22	20	50
28	20	25
35	20	20
42	20	20
54	20	20
76	25	25
108	25	25
Steel		
21	40	-
27	20	45
34	20	25
42	20	20
48	20	20
60	20	20
76	25	25
89	25	25

- Basis BS 5422 Table 29: Initial water temperature +2°C, evaluation period 12hrs thermal conductivity calculated from the mean insulation temperature based on the fluid and air temperatures.
- If mineral wool is used on pipes smaller than 20mm NB the required insulation thickness is too large to be applied in practice. To provide the appropriate degree of frost protection a combination of insulation and trace heating will be required.
  - Indoor condition is for ambient air temperature of -6°C, permitted ice formation of 50%.
  - Outdoor condition is for ambient air temperature of -10°C, permitted ice formation of 50%.

2460 CONDENSATION CONTROL ON CHILLED AIR DUCTWORK - ROCK MINERAL WOOL:

- Insulation thickness for condensation control on ductwork carrying chilled air in ambient conditions: indoor still air temperature 25°C, relative humidity 80%, dew point temperature 21.3°C.

Minimum air temperature inside duct °C	Thickness of rock mineral wool insulation (mm)		
Surface emissivity	Low (0.05)	Medium (0.44)	High (0.90)
15	30	25	25
10	50	25	25
5	70	40	25
0	90	50	30

- Basis: Table 12 in BS 5422, thermal conductivity values calculated from the mean insulation temperature based on the fluid and air temperatures.
- All ductwork shall be insulated where were visible (i.e exposed ductwork) when the duct surface temperature is below the dew point of the air within the space served.

3010 GENERAL:
- Install insulation in accordance with BS 5970.
- Carry out thermal insulation work using one of the scheduled firms employing skilled craftsmen conversant with class of work.
- In locations where insulation cannot be installed adequately after pipeline or ductline installation, pre-insulated sections shall be installed. Insulation to such sections shall be equivalent in thermal and physical properties to that specified for the remainder of the system including vapour barriers.
- Do not apply thermal insulation until installation has been fully tested and all joints proved sound.
- Ensure all materials are kept dry.
- Ensure all pipework surfaces are dry before the installation of thermal insulation.
- Insulate each unit separately. Do not enclose adjacent units together.
- Ensure there is clearance between insulated pipes.
- Application
  - Apply insulants, facings, coatings and protection strictly in accordance with manufacturer's instructions.
- Finish
  - Neatly finish joints, corners, edges and overlaps and, where possible, arrange overlaps to fall on blind side. Ensure overlaps are neat and even and parallel to circumferential and longitudinal joints.

3020 INSTALLATION OF FOIL FACED MINERAL WOOL INSULATION ON PIPEWORK:
- Ensure joints are close butted together. Secure overlaps with adhesive or matching class 'O' tape, a minimum of 50mm wide, on both longitudinal and circumferential butt joints. Insulate fittings to same standard as adjacent pipework and use mitred segments where necessary, taped as above.
- Where a vapour seal or fibre containment is required tape exposed insulation membrane and return to pipe surface.
- Where insulation abuts pipe support inserts that have integral vapour barriers seal using class 'O' foil tape to continue vapour barrier or containment.

3060 INSTALLATION OF FOIL FACED RIGID OR SLOTTED PHENOLIC INSULATION ON DUCTWORK:
- Secure the insulation with adhesive in accordance with manufacturer's recommendations. Use insulation hangers that are fit for purpose and in accordance with thermal insulation and insulation hanger manufacturers.
- Cut slabs so that the top and bottom pieces overlap the sides. Seal joints and pin penetrations using 100mm wide class 'O' aluminium foil tape.
- Where cut outs for test holes, etc occur tape over insulation membrane and return to the duct surface.
- Where insulation abuts duct support inserts that have integral vapour barriers seal using class 'O' foil tape to continue vapour barrier.

3070 INSTALLATION OF FOIL FACED FLEXIBLE DUCTWORK INSULATION:
- Secure the insulation with adhesive in accordance with manufacturer's recommendations. Use insulation hangers spaced at maximum 300mm centres on the underside of rectangular and flat oval ducts.
- Seal joints and pin penetrations using 100mm wide class 'O' aluminium foil tape. Where cut outs for test holes, etc occur tape over insulation membrane and return to the duct surface.
- Where insulation abuts duct support inserts that have integral vapour barriers seal using class 'O' foil tape to continue vapour barrier.

3120 INSTALLATION OF POLYISOBUTYLENE (PIB) PROTECTION:
- Wrap pipework and fittings, ductwork or tanks and vessels with PIB sheeting lapped at every joint by at least 50mm. Solvent weld joints and support with banding in accordance with manufacturer's
- Arrange joints to shed water and prevent the ingress of water.

3125 INSTALLATION OF MULTI-LAYERED LAMINATE:
- Install laminated foil/film protection, in accordance with manufacturer's instructions.
- Installation may be either factory pre-applied or applied in-situ.
- Ensure all surfaces are dry and clean, free from dust, oil and grease/silicone.
- Arrange joints to give water shed with the lap facing down.

3130A INSTALLATION OF SHEET METAL FINISH ON PIPEWORK:
- Secure insulation with metal bands at each end of section and at maximum centres of 450mm. Form sheet metal to fit tightly over the outer circumference of insulation with a longitudinal overlap of at least 40mm. Secure the outer part of overlap with self tapping screws or rivets at centres of not more than 150mm. Not on pipes with vapour barrier; or metal bands of same material.
- Ensure circumferential overlaps are at least 50mm, secured with self tapping screws or rivets. Make provision to accommodate expansion and contraction at intervals. Ensure all joints are lapped to shed liquids and seal all joints exposed to weather or spillage. Cover all bends and fittings with matching sheet metal, tailored to fit and sealed as appropriate. Fit pre-insulated, purpose-designed boxes to valves, flanges, etc.

3140A INSTALLATION OF SHEET METAL FINISH ON DUCTWORK, TANKS AND VESSELS:
- Form sheet metal to fit tightly over the insulation with a longitudinal overlap of at least 40mm. Secure the outer part of overlap with self tapping screws or rivets at centres of not more than 150mm. Not on vapour sealed ducts; or metal bands of same material.
- Ensure circumferential overlaps are at least 50mm, secured with self tapping screws or rivets. Make provision to accommodate expansion and contraction at intervals. Ensure all joints are lapped to shed liquids and seal all joints exposed to weather or spillage. Cover all bends and fittings with matching sheet metal, tailored to fit and sealed as appropriate.

3170 INSTALLATION OF ALUMINIUM SHEETING PROTECTION:
- Secure lapped joints (at least 40mm) by means of pop rivets at a maximum spacing of 150mm. For cold piping use matching aluminium straps at maximum spacing of 225mm. On piping operating below ambient temperature seal all joints against moisture. For external use make joints shed water and use sheets with treated surface.
- Where `lockform' seams are used submit proposals for dealing with surfaces curved in three dimensions.

3210 FLANGES AND VALVES:
- Cut back to allow removal of bolts and nuts, finish with neat bevel or use end caps.

Where boxes are used fit over insulation on adjacent piping. Ensure operation of valve remains unimpaired with box in place.

3230A INSTALLATION WHERE INSULATION IS CARRIED THROUGH PIPELINE SUPPORT:
- For load bearing insulation, carry through insulation and finish.
- For non-load bearing insulation on hot pipework close butt to a section of load bearing finished material minimum 100mm long.
- For non-load bearing insulation on cold pipework, close butt to high density phenolic foam pipe supports. Ensure the vapour barrier is maintained.

3250 INSTALLATION WHERE INSULATION IS CARRIED THROUGH DUCTWORK SUPPORT:
- Provide insulation between duct and support using high density phenolic foam strips. Butt insulation to spacer and carry over finish by 40mm and tape joint. Provide a sheet metal protecting sleeve. Load bearing materials must have a suitable compressive strength for the applied load.

3260 LIQUID VAPOUR BARRIERS:
- Apply vapour seal solution evenly by brush in accordance with manufacturer's instructions; use solution which dries to a colour distinctive from insulating material.

3270 INTEGRITY OF VAPOUR BARRIERS:
- Where a vapour barrier is indicated ensure its integrity throughout. Repair immediately any damage to vapour barriers and where such barriers have been applied off site, repair to manufacturer's

instructions. Where aluminium sheeting is used for protection, submit proposals for securing sheeting without impairing the integrity of the vapour seal for approval.

BS APPENDIX

BS 476-7:1997
Fire tests on building materials and structures. Part 7 Method of test to determine the classification of the surface spread of flame of products

BS 3533:1981
Glossary of thermal insulation terms

BS 5422:2009
Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C

BS 5970:2012
Thermal insulation of pipework, ductwork, associated equipment and other industrial installations in the temperature range of -100°C to +870°C. Code of practice

BS EN 13501-1:2018
Fire classification of construction products and building elements. Classification using test data from reaction to fire tests

BS EN 13823:2010+A1:2014
Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item

BS EN 14303:2015
Thermal insulation products for building equipment and industrial installations. Factory made mineral wool products (MW). Specification.

BS EN 14304:2015
Thermal insulation products for building equipment and industrial installations. Factory made flexible elastomeric foam (FEF) products. Specification.

BS EN 14314:2015
Thermal insulation products for building equipment and industrial installations. Factory made phenolic foam (PF) products. Specification.

BS EN 15804:2012+A1:2013
Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products.

BS EN 16783:2017
Thermal insulation products. Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations.

BS EN ISO 1182:2010
Reaction to fire tests for products. Non-combustibility test

BS EN ISO 1716:2018
Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)

BS EN ISO 12241:2008
Thermal insulation for building equipment and industrial installations. Calculation rules

Y51 TESTING AND COMMISSIONING OF MECHANICAL SERVICES

2010 PRESSURE TESTING - GENERAL:

- Comply with procedures given in TR/6 Site pressure testing of pipework. Building Engineering Services Association. Guide to good practice. Ensure safety precautions detailed in, HSE Guidance Note GS4 Safety requirements for pressure testing, are adopted.
- Provide a blanked connection to accommodate a check gauge in addition to the accurate gauge fitted to section under test.
- Test concealed or buried pipework before any permanent covering is applied.
- Advise appropriate personnel, in advance, of the time pressure tests may be witnessed.

2015 PRESSURE AND LEAKAGE TESTING - BUILDERS' WORK SHAFTS, VOIDS, ENCLOSURES AND FLOOR PLENUMS:

- Ensure all builder's work shafts, voids and enclosures are pressure and leakage tested, and signify acceptance of standard and integrity of construction, prior to pre-commissioning of engineering installations.
- Pressure test floor plenums / voids using a specialist building airtightness tester ATTMA registered to level 2, using ATTMA standard TSL2 and BSRIA BG 65/2016 - Floor Plenum Airtightness Guidance and Testing Methodology.
- Maximum value of plenum air leakage to be 0.7l/s/m^2 of floor area at a test pressure of 50Pa or 5% of the air volume flow rate supplied to the plenum.
- Maximum raised access floor leakage to be 1.0l/s/m^2 of floor area without carpets, at a test pressure of 50Pa.

2020 PRESSURE TESTING - WATER CIRCULATING AND SUPPLY SYSTEMS AND STEAM AND CONDENSE LINES:

- Carry out hydraulic pressure testing as described in TR/6 Site pressure testing of pipework. Building Engineering Services Association. Guide to good practice. Test section by section for one hour, as the work proceeds and prior to application of thermal insulation as follows
  - Operating gauge pressure less than 3.5 bar, test gauge one and a half times the maximum working pressure.
  - Operating gauge pressure 3.5 - 7.0 bar, test gauge pressure twice the maximum working pressure.
  - Operating gauge pressure greater than 7.0 bar, test gauge pressure 14.0 bar or one and a half times the maximum working pressure, whichever is the greater.
- Comply with BESA TR/20 Part 8 for steam and condensate system.

2040 PRESSURE TESTING - WATER MAINS:

- Test to Local Authority requirements. Ensure the provisions laid down in: TR/6 Site pressure testing of pipework. Building Engineering Services Association. Guide to good practice; for testing underground CWS mains are carried out.

2060 PRESSURE TESTING - GAS PIPEWORK:

- Carry out a pneumatic leak test followed by a pneumatic pressure test as described in TR/6 Site pressure testing of pipework. Building Engineering Services Association. Guide to good practice.
- Pressure test and commission of gas infrastructure (external to buildings) in accordance with BS EN 12327
- Comply with IGE/UP/1: Strength testing, tightness testing and direct purging of industrial and commercial gas installations.
- Comply with IGE/UP/1A: Strength testing, tightness testing and direct purging of small, low pressure industrial and commercial Natural Gas installations. Applicable to systems having a volume not exceeding 1m^3.
- Comply with IGEM/UP/1B: Tightness testing and direct purging (Domestic). Applicable to installations with a nominal bore not greater than 35mm, capacity through the primary meter not exceeding 16m^3/h and a maximum installation volume of 0.035m^3.

2075 TESTING CONDENSE AND OVERFLOW SYSTEMS:

- Test condensate drainage systems from cooling coils and any overflow pipework / drainage pipework from plant in accordance with BS EN 12056-2 and TR/6 Site pressure testing of pipework.

Building Engineering Services Association. Guide to good practice.

2080 PRESSURE TESTING - SOIL, WASTE, VENTILATION, ANTI-SYPHON AND RAINWATER PIPEWORK:
- Test section by section as the work proceeds and subsequently on completion with all sanitary fittings fixed and working. Submit systems to two separate tests: Air test and Hydraulic Performance test in accordance with BS EN 12056-2.

3020 COMMISSIONING CODES:
- Carry out commissioning of installations in accordance with the procedures, checks and tolerances given in the BSRIA Application Guides for water systems and air systems to achieve the standards set in the CIBSE Commissioning Codes.

3025 SEASONAL COMMISSIONING:
- Provide appropriately qualified personnel and all necessary equipment and materials to execute the seasonal commissioning works. The same organisation / team that carried out the original construction works shall undertake the seasonal commissioning.
- A schedule of suitable working periods and essential services to be maintained during any work will be provided by the building operator.
- A programme for the works shall be provided at least 1 month prior to the start date. This should account for any phased hand overs, cause as little disruption as possible and ensure essential services are maintained.
- The works shall comply with all statutory and client specific Health and Safety requirements.
- Any performance deficiencies found during seasonal commissioning shall be corrected.
- All seasonal commissioning shall be carried out in accordance with the project commissioning specification, an approved method statement, manufacturers' guidelines and the day-to day operational requirements of the building users.
- Record all seasonal commissioning works and after completion of the works update all building documentation including O&M manuals, Building Manual, Building Log book, Building User Guide and the Building Information Model (BIM). Any changes made to the systems during the works shall be clearly identified.
- BREEAM New Construction 2018 requirements:
  - Comply with Issue ID Man 04 Commissioning and Handover
  - Comply with Issue ID Man 05 Aftercare

3030 COMMISSIONING WATER DISTRIBUTION SYSTEMS:
- Preliminary checks
  - Carry out checks and procedures as detailed in CIBSE Commissioning Code W. Ensure system is statically complete as defined in Section 4 of BSRIA Guide BG 2/2010 - Commissioning Water Systems.
  - Use pre-commissioning checklist from BSRIA Guide BG 2/2010.
- Setting to work and regulation
  - Set to work and regulate water distribution systems in accordance with CIBSE Commissioning Code W and BSRIA Guide BG 2/2010.
- Measurement
  - Use instruments for measurement detailed in BSRIA Guide BG 2/2010.

3040 COMMISSIONING AIR DISTRIBUTION SYSTEMS:
- Preliminary checks
  - Carry out checks and procedures as detailed in BSRIA Guide BG 49/2015 Commissioning Air Systems.
  - Use pre-commissioning checklist in BSRIA Guide BG 49/2015.
- Setting to work and regulate
  - Set to work and regulate constant and variable flow air distribution systems in accordance with CIBSE Commissioning Code A and BSRIA Guide BG 49/2015.
- Measurement of air flow
  - Use instruments for measurement and methods of measurement detailed in BSRIA Guide BG 49/2015 and CIBSE Commissioning Code A.
- Undertake tests and checks to ventilation and air conditioning systems generally in accordance with

BS EN 12599 in order to verify the fitness for purpose of the installed systems before, during and after handover. Method statement to include relevant checklists from BS EN 12599.

3050 COMMISSIONING BOILER PLANT:
- Follow the procedures laid down for carrying out Preliminary Checks and Start Operation in accordance with CIBSE Commissioning Code B and manufacturers instructions.
- Apparatus and Instruments
  - Use Apparatus and Instruments detailed in CIBSE Commissioning Code B, Appendix BA1. Apply tolerances defined in Appendix BA1.

3055 COMMISSIONING OF GAS PLANT AND SYSTEMS:
- Commission gas fired plant on industrial and commercial premises in accordance with IGEM/UP/4.
- Commission gas infrastructure (external to buildings) supply systems in accordance with BS EN 12327
- Undertake all completion procedures detailed in Section 17 of IGEM/UP/2 Edition 3 and provide pipework commissioning checklist based on Appendix 16 in IGEM/UP/2.

3060 COMMISSIONING REFRIGERATING SYSTEMS:
- Follow the procedures given for use and handling of refrigerants, pressure and leak testing, evacuation and dehydration, charging and lubrication of refrigerating systems in CIBSE Commissioning Code R and manufacturer's instructions.
- Pre-commissioning:
  - Carry out the procedures for pre-commissioning detailed in CIBSE Commissioning Code R, Section R5.
- Combined pressure and leak testing:
  - Carry out the procedures for combined pressure and leak testing, including refrigerant charging, detailed in CIBSE Commissioning Code R, Section R6.
- Setting to work and adjusting
  - Carry out the procedures for setting to work and adjusting detailed in CIBSE Commissioning Code R7.
- Absorption Systems.
  - Carry out the procedures for Preliminary Checks, Testing and Charging, and Setting to Work and adjusting detailed in CIBSE Commissioning Code R, Section R10.
- Apparatus and Instruments
  - Use Apparatus and Instruments detailed in CIBSE Commissioning Code R, Section R8. Apply tolerances defined in Section R8.6.

3090A INSTRUMENTS AND GAUGES:
- Ensure instruments are correctly calibrated. Record details of instruments on record sheets.
- Submit evidence of correct calibration of instruments to be used in connection with commissioning and testing.

3100A AIR SYSTEMS COMMISSIONING RECORDS TO BSRIA BG 49/2015:
- Keep a systematic record of commissioning results and distribute as indicated.
- For air systems
  - Use record sheets as described in BSRIA Guide BG 49/2015 Commissioning Air Systems.

3100B WATER SYSTEMS COMMISSIONING RECORDS TO BSRIA GUIDE BG 2/2010:
- Keep a systematic record of commissioning results and distribute as indicated.
- For water systems
  - Use record sheets as detailed in BSRIA Guide BG 2/2010 Commissioning Water Systems.

3110 BMS COMMISSIONING - CONTROL SYSTEM SPECIFICATION DETAILS REQUIRED FOR COMMISSIONING:
- Ensure that the following information is supplied to the commissioning engineer:
  - A network schematic providing a record of the overall control system architecture.
  - Schematics of the systems to be controlled indicating the location of sensors and actuators.
  - A written description of the configured control strategies.
  - Control strategy logic diagrams in the form of logic flow charts.

- Set-points and other control settings such as initial default parameters for control loops relating to the control strategies.
- Criteria relating to control accuracy and stability.
- A points list including digital inputs/outputs and analogue inputs/outputs.
- Control panel drawings.
- BMS operator workstation graphics and associated point data displaying monitored conditions.
- Trend logging archiving requirements and alarm routing.
- The scope of operational and specified functionality of management software, e.g. utility monitoring and targeting software.
- Functional requirements of any occupant interfaces.
- Details of any hard-wired interfaces from, or to, other control devices.
- Functionality and scope of data to be transferred over any gateway for use as part of an integrated system.
- Functional profiles for any direct interoperability integration.

- Ensure that the following is included in the BMS commissioning specification:-
  - A clear description of the division of responsibility between the various parties.
  - Off-site and on-site pre-commissioning procedures.
  - On-site commissioning procedures.
  - Requirements for assistance to air and water balancing testing (e.g. opening and closing control valves) and other plant tests where the controls need to be overridden.
  - A requirement for any point-by-point verification of correct operation.
  - Requirements for evaluation of control loop performance/loop tuning.
  - Requirements for the BMS operator workstation for assistance in the commissioning of plant.
  - Arrangement for the management of delays.
  - Phased completion requirements.
  - Requirements for demonstration/witness testing on the basis of a percentage of points or on a point-by-point basis. Ensure that the witnessing requirement includes the identification of those responsible.
  - Requirement for software/configuration data back-up.
  - Requirement for, and involvement in, any complete system and sub-system performance testing.
  - Requirement for system documentation.
  - Requirement for operator training requirements.
  - Requirement for post occupancy checks.

3120 BMS COMMISSIONING - PRE-COMMISSIONING:

- Ensure that as much pre-commissioning work as possible is performed off-site:
- Ensure that the following is followed:
  - Pre-commissioning requirements

Pre-commissioning action	Pre-commissioning off-site
Control application software	Yes (final commissioning on-site)
User interface software	Yes (final commissioning on-site)
Control panels	Yes (final commissioning on-site)
Terminal units (fan coil units, etc)	Yes (final commissioning on-site)
Wiring	No
Communications network	No
Sensors	No
Actuators	No
Integration gateways	Partial

- Ensure that a record of all settings, set-points and offsets are maintained throughout the pre-commissioning period.
- Ensure that all final physical adjustments to the field devices are indelibly marked.
- Ensure that all packaged plant interfaced with the BMS is fully tested and commissioned by the

manufacturer or installer.
- Ensure that the BMS is pre-commissioned in accordance with the following requirements of CIBSE Code C (Commissioning of automatic control systems).
  - CIBSE Code C automatic control systems pre-commissioning requirements

Pre-commissioning action	CIBSE Code C section reference
Control applications software	C5.2
Control panels	C5.3
Wiring	C5.4
Communications networks	C5.5
Sensors	C5.6
Actuators and valves	C5.7
Digital inputs/outputs	C5.8
Pneumatic actuation with microprocessor control	C5.9
Field control devices	C5.10

3130A BMS COMMISSIONING - PLANT READY FOR CONTROL SYSTEM COMMISSIONING:
- Confirm that the following plant commissioning has been performed before commencing the final BMS commissioning:
- Water systems
  - The system is cleaned and flushed to remove any debris.
  - All regulating, isolating and control valves in place and operating correctly.
  - That all flow measuring devices are in place and in the correct location for accurate measurement (including pressure tappings).
  - The system is vented.
  - That the proportional balancing is completed to obtain the branch flow rates in the correct ratio to each other (or through the use of and setting of self-balancing valves).
  - That the pump flow rate has been adjusted to provide the specified flow rate.
- Air systems
  - Debris has been removed from the air distribution system.
  - That dampers are in the correct location and fully functional.
  - That fire/smoke dampers open.
  - Test holes have been drilled and sealed with removable plugs.
  - That in-situ flow measuring devices have been installed.
  - Ductwork air leakage testing has been performed (if specified).
  - Completion of proportional balancing of regulating dampers so that terminals share the air flow in the correct proportions.
  - Regulation of the fan(s) to provide the specified flow rate.
- Packaged equipment
  - Ensure that plant and controls have been fully commissioned and are functional, ready for integration with other plant/systems.
  - That control equipment inputs/outputs are in the specified format for connection to the main control system.
- Confirm that the plant is commissioned in accordance with:
  - Air distribution systems, CIBSE Code A
  - Boiler plant, CIBSE Code B
  - Refrigeration systems, CIBSE Code R
  - Water distribution systems, CIBSE Code W
  - BSRIA Guide BG 49/2015 Commissioning Air Systems
  - BSRIA Guide BG 2/2010 Commissioning Water Systems

3140 BMS COMMISSIONING - CONTROL SYSTEM REQUIREMENTS FOR PLANT COMMISSIONING:
- Ensure that the BMS is pre-commissioned to allow the building services plant to operate under "manual" running conditions.
- Ensure that the control valves can be manually set in their fully open position to allow the balancing

of pipework flows.
• Ensure that dampers can be manually opened to allow the commissioning of air systems.

3150 BMS COMMISSIONING:
• Ensure that the BMS is commissioned in accordance with the following requirements of CIBSE Code C (Commissioning of automatic control systems).
  • Control strategy checking - C6.2
  • Checking procedures for basic control functions - C6.3
  • Lighting controls - C6.4
  • Operator workstations - C6.5
  • Occupant interfaces - C6.6
  • Communication networks - C6.7
  • Integrated systems - gateways - C6.8
  • Integrated systems - direct interoperability - C6.9
  • Integration with fire detection systems - C6.10
  • Security systems - C6.11
  • Interruption of electrical power supplies - C6.12
  • Valves - C7.1
  • Dampers - C7.2
  • Fans - single speed - C7.3
  • Fans - variable speed - C7.4
  • Pumps - C7.5
  • Terminal units - C7.6
  • VRF systems - C7.7
  • Cooling coils - C7.8
  • Chilled water dehumidification coil - C7.9
  • LTHW heating coils - C7.10
  • Electric heater barriers - C7.11
  • Humidifier, steam and atomised spray types - C7.12

4010 SYSTEM PERFORMANCE TESTING / DEMONSTRATIONS:
• Demonstrate the performance and control sequence, including the operation of all safety devices of installations including single, standby, multi-duty plants and systems, and of plants specified for future use.

4015 TESTING OF RESIDENTIAL VENTILATION SYSTEMS:
• Demonstrate the performance of residential ventilation systems through performance testing and installation checks in accordance with BS EN 14134.
• Comply with the best practice requirements of BSRIA BG 46/2015 Domestic Ventilation Systems - A guide to measuring air flow rates, for measurement of air flow rates use the unconditional method.

4020A ENVIRONMENTAL TESTS, ARTIFICIAL LOADS:
• Carry out environmental testing to prove the performance of the systems.
• Apply artificial loads in the spaces to be tested including sensible and later heat emitters or provide test arrangements to simulate the full range of operating conditions and duties.

4020B ENVIRONMENTAL TESTS, AMBIENT AIR QUALITY
• Carry out environmental testing to prove the performance of the systems.
• Carry out ambient air quality tests in accordance with BS EN 13528-1, BS EN 13528-2 and BS EN 13528-3.

4030 RECORDERS:
• Provide and maintain on free loan portable seven day space temperature and relative humidity recorders, as indicated, together with adequate charts.

BS APPENDIX

BS EN 12056-2:2000

Gravity drainage systems inside buildings. Part 2 Sanitary pipework, layout and calculation
BS EN 12327:2012
Gas infrastructure. Pressure testing, commissioning and decommissioning procedures. Functional requirements

BS EN 12599:2012 :
Ventilation for buildings. Tests procedures and measuring methods to hand over air conditioning and ventilation systems

BS EN 13528-1:2002
Ambient air quality. Diffusive samplers for the determination of concentrations of gases and vapours. Requirements and test methods. Part 1 General requirements

BS EN 13528-2:2002
Ambient air quality. Diffusive samplers for the determination of concentrations of gases and vapours. Requirements and test methods. Part 2 Specific requirements and test methods

BS EN 13528-3:2003
Ambient air quality. Diffusive samplers for the determination of concentrations of gases and vapours. Requirements and test methods. Part 3 Guide to selection, use and maintenance

BS EN 14134:2004
Ventilation for buildings. Performance testing and installation checks of residential ventilation systems

Y52 VIBRATION ISOLATION MOUNTINGS

1010 DESIGN INTENT:
- Supply equipment indicated to ensure that vibration from equipment is not transmitted to building, other supporting structure, pipework or ductwork.

1020 SPRING ANTI VIBRATION MOUNTINGS:
- Select spring mounts with an overload capacity of 50%, for metal springs the outside diameter should be at least 75% of operating height. Permanently identify individual mounts with their load capacity.

1040 LOCKING FACILITY:
- Where indicated, provide lockable levelling device.

2010A SYNTHETIC MATERIAL CONFIGURED MAT MOUNTINGS:
- Provide configured mat mountings manufactured from neoprene or composite fibre/synthetic rubber.
- Where mats are stacked, bond 1mm steel sheet thickness between each pad without filling voids.

2010B NATURAL RUBBER CONFIGURED MAT MOUNTINGS:
- Provide configured mat mountings manufactured from natural rubber.
- Where mats are stacked, bond 1mm steel sheet thickness between each pad without filling voids.

2010C HIGH TEMPERATURE CONFIGURED MAT MOUNTINGS:
- Provide configured mat mountings manufactured from high temperature synthetic rubber.
- Where mats are stacked, bond 1mm steel sheet thickness between each pad without filling voids.

2010D RESILIENT MAT MOUNTINGS:
- Provide a minimum of 20mm resilient mat and sheet of 1.6 mm steel for incorporation in cast in situ base.

2010E PAD MOUNTINGS:
- Provide pad mountings manufactured from composite synthetic rubber.

2060 SPRING COMPRESSION HANGERS:
- Provide spring compression hangers comprising high strength low stress helical spring capped with steel pressure plate, on resilient base pad, mounted within hanger box.
- Construct hanger box from steel (minimum thickness 1.6mm) complete with hole for suspension rod and enlarged lower hole for drop rod to equipment.

2070A SYNTHETIC RUBBER HANGERS, COMBINED TURRET/SPRING COMPRESSION:
- Provide turret/spring compression hangers with turret fabricated from synthetic rubber and high strength low stress helical spring capped with steel pressure plate, on resilient base pad, incorporated within hanger box.
- Construct hanger box from steel (minimum thickness 1.6mm) complete with hole for suspension rod and enlarged lower hole for drop rod to equipment.

2070B NEOPRENE HANGERS, COMBINED TURRET/SPRING COMPRESSION:
- Provide turret/spring compression hangers with turret fabricated from neoprene and high strength low stress helical spring capped with steel pressure plate, on resilient base pad, incorporated within hanger box.
- Construct hanger box from steel (minimum thickness 1.6mm) complete with hole for suspension rod and enlarged lower hole for drop rod to equipment.

2090A CONCRETE/STEEL FORMWORK INERTIA BASES:
Provide purpose built inertia bases constructed using welded steel frame formwork containing concrete reinforced with 12mm minimum diameter bars at 100mm maximum centres, 35mm above the bottom of the base; and mounted on spring compression mountings.

2090B WELDED STEEL FRAME INERTIA BASES:

• Provide purpose built inertia bases constructed using welded steel frame mounted on spring compression mountings.

2100 VIBRATION ISOLATION HOSES:
• Provide flexible hose couplings for connecting pipework comprising nylon fabric or steel mesh carcass with waterproof cover and internal lining of material to suit fluid conveyed, temperatures and pressures indicated.

2110A NATURAL CORKWOOD PIPEWORK NOISE VIBRATION ISOLATION:
• Incorporate within pipework support ring purpose made isolators manufactured from natural corkwood of density 160 kg/cubic metre, impregnated with fungicide, individually bound with steel strip not more than half depth of isolator.

2110B RECONSTITUTED CORKWOOD PIPEWORK NOISE VIBRATION ISOLATION:
• Incorporate within pipework support ring purpose made isolators manufactured from resin bonded reconstituted soft corkwood granules, of density 100 kg/cubic metres.

2110C RUBBER MATTING PIPEWORK NOISE VIBRATION ISOLATION:
• Incorporate within pipework support ring purpose made isolators manufactured from rubber matting.

2120A SPONGE FOAM PIPE WALL AND RISER SEALS:
• Provide pipe sleeves, minimum length 300mm, with minimum 25mm dense sponge foam lining bonded internally.

2120B MINERAL FIBRE PACKING PIPE WALL AND RISER SEALS:
• Provide pipe sleeves, minimum length 300mm, with minimum 52mm mineral fibre packing lining bonded internally.

3040 HORIZONTALLY RESTRAINED SPRING MOUNTINGS:
• Ensure snubbers for limiting excessive movement are installed out of contact during normal operation.

Y54 IDENTIFICATION - MECHANICAL

1010 REQUIREMENTS:
- Identify all pipework, ductwork, equipment, appliances and ancillaries comprising the various systems.

1020 NEW SYSTEMS:
- Comprehensively label and colour code throughout works as indicated.

1040 COLOURS:
- As indicated to colour ranges given in BS 381C and BS 4800.

1045 PERFORMANCE AND DURABILITY:
- Ensure durability of identification for safety purposes is to BS ISO 17398.

2010 PIPEWORK IDENTIFICATION:
- Standards - Colour code and label to BS 1710.
- Primary Identification
  - Apply colour bands, 300mm wide, to each pipe at least
    - Once in every room or enclosed area.
    - At intervals not exceeding fifteen metres.
    - At every junction.
    - At every valve.
    - At every inspection and access position into service shafts, false ceilings, bulkheads etc.
- Secondary Identification
  - Apply colour bands, 50mm wide, and superimpose a legend identifying circuit, direction of fluid or gas flow, nominal pipe bore and, where appropriate, fluid or gas pressure.
- Legends
  - Apply to colour bands by transfers of an approved type.

2020 DUCTWORK IDENTIFICATION:
- Standards
  - Generally colour code and label to BESA DW/144.
- Primary Identification
  - Apply colour bands, 300mm wide, to each duct at least
  - Once in every room or enclosed area.
  - At intervals not exceeding fifteen metres.
  - At every junction.
  - At every damper.
  - At every inspection and access position into service shafts, false ceilings, bulkheads etc.
- Secondary Identification
  - For ducts with longest side or diameter up to and including 225mm. Paint colour bands 50mm wide and superimpose legends.
  - For ducts with longest side or diameter over 225mm. Paint or apply transfers to identification triangles, or triangular plates. Superimpose or incorporate legends.
- Triangular Plates
  - Attach to buckle bands or stool pieces and fix to ducting, with apex indicating direction of airflow. Submit details of plates and fixings for approval before painting and marking. Use equilateral triangle of side 150mm minimum.
- Legends
  - Apply transfers of an approved type to colour bands or triangles or triangular plates. Identify floor and space served, associated equipment reference and direction of airflow.

2030B PLANT AND EQUIPMENT IDENTIFICATION, LAMINATED PLATES:
- Standards
  - Identify each item of equipment by name and, where appropriate, by agreed reference characters. Provide colour identification as called for in work sections and, in all cases, colour fire fighting equipment red.

- Identification Colours
  - Use primary and secondary identification colours of associated system.
- Plates
  - Use rectangular metal or laminated plastic, securely fixed to each item of equipment.
- Lettering
  - Laminated plates, multi-coloured with outer layer removed for lettering.
- Legends
  - Engrave plates with an approved text. Incorporate operating duty of equipment where this is not incorporated in other labelling.

2035 GRAPHICAL SYMBOLS FOR USE ON EQUIPMENT IN ACCORDANCE WITH BS EN 80416:
- Graphical symbols for use on equipment to be created and applied in accordance with BS EN 80416-1, BS EN 80416-2, BS EN 80416-3.

2040 VALVE AND COCK IDENTIFICATION:
- Standards
  - Identify each valve, cock, stop valve, air vent, drain cock etc. with disc engraved with numerical reference. Except where exposed in occupied areas.
- Identification Colours
  - Use primary and secondary identification colours of associated system for painted or self colour discs.
- Discs
  - Securely attach metal or laminated plastic discs, minimum diameter 35mm, to each item.
- Legends
  - Engrave discs with permanent characters, minimum height 6mm.
- Incorporate in operating instructions relating to regulating valves and flow measuring equipment, details of flow rate, pressure differential and setting, as appropriate.

2070 AIR VOLUME REGULATING AND CONTROL DAMPER IDENTIFICATION:
- Standards
  - Identify each regulating and control damper. Except where exposed in occupied areas. On ductwork dampers, clearly indicate commissioning set point.
- Identification colours
  - Use primary and secondary identification colours of associated system for painted or self colour discs.
- Discs
  - Securely attach metal or laminated plastic discs, minimum diameter 35mm, to each item.
- Legends
  - Engrave discs with permanent characters, minimum height 6mm.

2080 INSTRUMENT IDENTIFICATION:
- Standards
  - Identify each instrument by name and, where appropriate, by agreed reference characters.
- Plates
  - Use rectangular metal or laminated plastic, securely fixed to each instrument.
- Legends
  - Engrave plates with an approved text.

2090 DANGER AND WARNING NOTICES:
- Hazardous Systems
  - Colour code and label hazardous systems and equipment to requirements of Health and Safety Executive Guidance Notes.

2100A SYSTEM IDENTIFICATION INSTALLATION CHARTS, PERSPEX GLAZED FRAME:
- System Schematics
  - Supply and fix a referenced schematic diagram (or diagrams) of all systems as installed, including equipment and ancillary schedules. Show scheduled information on diagram.
  - Identify all items by appropriate reference characters.

- Control Schematics
  - Supply and fix a referenced schematic diagram (or diagrams) of all control systems as installed, including equipment and ancillary schedules. Show scheduled information on diagram.
  - Identify all items by appropriate reference characters.
- Location
  - Fix in each boiler house, calorifier room, plant room or equipment room.
- Finish
  - Perspex sheet glazing with surrounding frame and mounting attachments.

BS APPENDIX

BS 1710:2014
Specification for identification of pipelines and services

BS 4800:2011
Schedule of paint colours for building purposes

BS EN 80416-1:2009
Basic principles for graphical symbols for use on equipment. Part 1 Creation of symbol originals

BS EN 80416-2:2001
Basic principles for graphical symbols for use on equipment. Part 2 Form and use of arrows

BS EN 80416-3:2002+A1:2011
Basic principles for graphical symbols for use on equipment. Part 3 Guidelines for the application of graphical symbols

BS ISO 17398:2004
Safety colours and safety signs. Classification, performance and durability of safety signs

Y61 CABLES AND WIRING

1010 CABLE MANUFACTURER:
- Use new cables, delivered to site with seals intact, manufactured not more than one year prior to delivery, labelled with manufacturer's name, size, description, BS number, classification, fire classification to BS EN 50575 and BS EN 13501-6, length, grade and date of manufacture.
- Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations) and BS 6701.
  - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
  - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
  - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule
  - Ensure all cables within the scope of BS 6701 meet BS EN 13501-6 EuroClass E_{ca}, or the requirements of BS EN 60332-1-2, except for cables intended for installation into pathways that are hidden below floors, behind walls, or to which access is limited, which are to meet at least BS EN 13501-6 EuroClass C_{ca}-s1b,d2,a2.

1020 CABLE CERTIFICATION MARKING:
- Mark all types of cables with CENELEC cable certification marking or if included in British Approvals Service for Cables (BASEC) in accordance with BASEC Regulations.

1030 MEDIUM VOLTAGE CABLE RECORDS:
- Keep records of MV cable drum numbers and supporting information, mark information on record drawings, indicating precise location of each length of cable, and submit copies of manufacturer's cable test certificate.

2005 LSOH SHEATHING:
- Supply cables with Low Smoke zerO Halogen (LSOH) sheathing, tested in accordance with BS EN 60754-1, BS EN 60754-2, BS EN IEC 60332 and BS EN 60332.

2010A STANDARD ORDINARY FLEXIBLE WIRES - SINGLE COPPER CORE:
- Standard - BS EN 50525-2-31, Clause 4.2, 4.4, and 5.4
- Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
  - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
  - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
  - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2010B STANDARD LSF FLEXIBLE WIRES - SINGLE COPPER CORE:
- Standard - BS EN 50525-3-41, Clause 4.2 and 4.4
- Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).

- Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
- Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
- Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2010C STANDARD HEAT RESISTING (90°C OR MORE) FLEXIBLE WIRES - SINGLE COPPER CORE:

- Standard - BS EN 50525-2-31 Clause 5.2; BS EN 50525-2-41, Class 5 conductors: Clause 4.1 and 4.3. BS EN 50525-2-42, Class 5 conductor: Clause 4.1
- Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
- Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
- Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
- Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2010D STANDARD ORDINARY FLEXIBLE MULTI-CORE COPPER CABLES:

- Standard - BS EN 50525-2-21, Clauses 4.1, 4.2, 4.3 and 6.3
- Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
- Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
- Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
- Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2010E STANDARD HEAT, OIL AND FLAME RESISTANT (HOFR) FLEXIBLE MULTI-CORE COPPER CABLES:

- Standard - BS EN 50525-2-21, Clause 6.3
- Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
- Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
- Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN

600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule

- Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2010F MULTICORE COPPER LOW SMOKE ZERO HALOGEN FLEXIBLE CABLES:

- Standard - BS EN 50525-3-11, Clause 4.2
- Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
- Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
- Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
- Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule.

2020A STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, THERMOSETTING INSULATION, SHEATHED:

- Standard - BS 5467, Tables 4, 6, 8, and 10.
- Mechanical protection - unarmoured.
  - Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
    - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2020B STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, THERMOSETTING INSULATION, SHEATHED AND ARMOURED:

- Standard - BS 5467, Tables 4, 6, 8, and 12.
- Mechanical protection - armour.
  - Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
    - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series

plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2020C STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, PVC INSULATION, SHEATHED:

- Standard - BS 6004, Tables 7 and 8.
- Mechanical protection - unarmoured.
  - Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
    - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2020E STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS, LSF SHEATHED AND ARMOURED:

- Standard - BS 6724, Tables 4, 6, 8, and 10.
- Mechanical protection - armour.
  - Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
    - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2020F STANDARD CABLES FOR CONDUIT AND TRUNKING, COPPER CONDUCTORS, PVC INSULATED:

- Standard - BS EN 50525-2-31, Clause 4.1, 4.3 and 4.4
- Mechanical protection - conduit and trunking.
  - Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
    - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2020G STANDARD CABLES FOR CONDUIT AND TRUNKING, COPPER CONDUCTORS, LSF INSULATED:

- Standard
  - BS EN 50525-3-41, Clauses 4.1 and 4.3
  - BS 8592
- Mechanical protection - conduit and trunking.
  - Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
    - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2020H STANDARD CABLES FOR CONDUIT AND TRUNKING, COPPER CONDUCTORS. 90°C PVC INSULATED:

- Standard - BS EN 50525-2-31, Clause 5.1, 5.3 and 5.4
- Mechanical protection - conduit and trunking.
  - Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
    - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2020I STANDARD FLAT CABLES, 2-CORE OR 3-CORE, COPPER CONDUCTORS, WITH OR WITHOUT CPC, PVC INSULATED, SHEATHED:

- Standard - BS 6004, Tables 7, 8 and 9.
  - Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
    - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2020J STANDARD FLAT CABLES, 2-CORE OR 3-CORE, COPPER CONDUCTORS WITH OR WITHOUT CPC, LSF INSULATED SHEATHED:

- Standard - BS 7211, Table 5.
  - Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
    - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2020K STANDARD POWER SUPPLY CABLES, COPPER CONDUCTORS LSF INSULATION, SHEATHED:

- Standard - BS 7211, Tables 3 and 4.
- Mechanical protection - unarmoured.
  - Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
    - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2020M STANDARD CABLES WITH DEFINITE FIRE PERFORMANCE:

- Standard - BS 7629-1 type as shown on drawings / schedules.
- Fire performance BS 5839-1 - standard.
- Sheath colour - red.
- Mechanical protection, as shown on drawings / schedules.
- Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).

2020N STANDARD CABLES FOR WALLS, PARTITIONS AND BUILDING VOIDS WHERE PENETRATION BY SHARP OBJECTS IS A HIGH RISK:

- Standard - BS 8436
- Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations).
    - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series

plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2030A STANDARD 3.3 KV, COPPER CONDUCTORS, ARMOURED AND LSF SHEATHED CABLES:
- Standard - BS 6622, Tables 2 and 3.
- Mechanical protection - armour.

2030B STANDARD 3.3 KV, COPPER CONDUCTORS, ARMOURED AND LSF SHEATHED CABLES:
- Standard - BS 6724, Tables 10 and 11.
- Mechanical protection - armour.

2030C STANDARD 11 KV, COPPER CONDUCTORS, ARMOURED AND SHEATHED CABLES:
- Standard - BS 6622, Tables 4 and 5.
- Mechanical protection - armour.

2040A LIGHT DUTY MINERAL INSULATED CABLES, THERMOPLASTIC OUTER COVERING:
- Standard - 500V light duty to BS EN 60702-1, section 14.
- Outer covering
  - Thermoplastic to BS EN 60702-1, section 8.2.

2040B LIGHT DUTY MINERAL INSULATED CABLES, LSF OUTER COVERING:
- Standard - 500V light duty to BS EN 60702-1, Section 14.
- Outer covering
  - Halogen free material to BS EN 60702-1, Section 8.3

2040C HEAVY DUTY MINERAL INSULATED CABLES, THERMOPLASTIC OUTER COVERING:
- Standard - 750V heavy duty to BS EN 60702-1, Section 15.
- Outer covering
  - Thermoplastic to BS EN 60702-1, Section 8.2

2040D HEAVY DUTY MINERAL INSULATED CABLES, LSF OUTER COVERING:
- Standard - 750V heavy duty to BS EN 60702-1, Section 15.
- Outer covering
  - Halogen free material to BS EN 60702-1, Section 8.3

2040E HEAVY DUTY MINERAL INSULATED CABLES, LSF OUTER COVERING:
- Standard - 750V heavy duty to BS EN 60702-1, Section 15.
- Outer covering
  - Halogen free material to BS EN 60702-1, Section 15.
- Fire performance BS 5839-1 - enhanced.
- Sheath colour - red.

2050A PAIRED, UNSCREENED CONTROL CABLES WITH OR WITHOUT METALLIC PROTECTION:
- Standard - BS EN 50288-7
- With or without metallic protection.
- Fire performance
  - Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations)
  - For telecommunications, information technology, communications and similar cables
    - Comply with the fire performance requirements of BS 6701 and BS EN 50575.
      - Ensure all telecommunications, information technology, communications and similar cables meet as a minimum BS EN 13501-6 EuroClass C_{ca}-s1b,d2,a2, or higher rating as indicated on the relevant cable schedule.
  - For power and auxiliary cables, and other cables outside the scope of BS 6701
    - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables to be installed where the risk of flame propagation is high (for example, cables

that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule

- Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2050B PAIRED, SCREENED CONTROL CABLES WITH OR WITHOUT METALLIC PROTECTION:

- Standard - BS EN 50288-7
- Paired, screened control cables, with or without metallic protection.
- Fire performance
- Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations)
  - For telecommunications, information technology, communications and similar cables
    - Comply with the fire performance requirements of BS 6701 and BS EN 50575.
      - Ensure all telecommunications, information technology, communications and similar cables meet as a minimum BS EN 13501-6 EuroClass C_{ca}-s1b,d2,a2, or higher rating as indicated on the relevant cable schedule.
  - For power and auxiliary cables, and other cables outside the scope of BS 6701
    - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2050G MULTICORE UNARMOURED LSF, SHEATHED AUXILIARY CABLES:

- Standard - BS 7211, Table 4.
- Mechanical protection - unarmoured.
- Fire performance
  - Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations)
  - For telecommunications, information technology, communications and similar cables
    - Comply with the fire performance requirements of BS 6701 and BS EN 50575.
      - Ensure all telecommunications, information technology, communications and similar cables meet as a minimum BS EN 13501-6 EuroClass C_{ca}-s1b,d2,a2, or higher rating as indicated on the relevant cable schedule.
  - For power and auxiliary cables, and other cables outside the scope of BS 6701
    - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2050H MULTICORE ARMOURED LSF, SHEATHED AUXILIARY CABLES:
- Standard - BS 6724, Table 9.
- Mechanical protection - armour.
- Fire performance
  - Ensure all cables are certified in accordance with the Construction Products Regulation (CPR) as required by BS 7671 (IET Wiring Regulations)
  - For telecommunications, information technology, communications and similar cables
    - Comply with the fire performance requirements of BS 6701 and BS EN 50575.
      - Ensure all telecommunications, information technology, communications and similar cables meet as a minimum BS EN 13501-6 EuroClass C_{ca}-s1b,d2,a2, or higher rating as indicated on the relevant cable schedule.
  - For power and auxiliary cables, and other cables outside the scope of BS 6701
    - Ensure all cables meet at least either BS EN 60332-1-2 or BS EN 13501-6 EuroClass E_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables to be installed where the risk of flame propagation is high (for example, cables that are bunched or are used in long vertical runs), or in a fire propagating structure, or run in a fire segregated compartment, meet at least either BS EN 60332-1-2 plus the relevant part of the BS EN 600332-3 series and BS EN IEC 60332-3 series, or BS EN 13501-6 EuroClass D_{ca}, or higher rating as indicated on the relevant cable schedule
    - Ensure cables encroaching on or run in escape routes meet at least either BS EN 13501-6 EuroClass D_{ca}-s2, or the relevant part of BS EN 600332-3 series and BS EN IEC 60332-3 series plus achieve at least 60 % light transmittance when tested to BS EN 61034-2, or higher rating as indicated on the relevant cable schedule

2050I CONTROL AND AUXILIARY CABLES WITH DEFINITE FIRE PERFORMANCE:
- Standard - BS 7629-1; type as shown on drawings / schedules.
- Fire performance approval - Loss Prevention Certification Board (LPCB).
- Fire performance STANDARD 30, STANDARD 60 or ENHANCED 120 as indicated on the relevant schedule, or as otherwise required by the design of the system in accordance with BS 5839-1 or BS 5266-1.
- Sheath colour - red.
- Mechanical protection, as shown on drawings / schedules.

2050K FIRE ALARM CABLE:
- Standard - BS 7629-1.
- Mechanical protection - unarmoured.
- Fire performance STANDARD 30, STANDARD 60 or ENHANCED 120 as indicated on the relevant schedule, or as otherwise required by the design of the system in accordance with BS 5839-1 or BS 5266-1.

2070B STANDARD COMMUNICATIONS CABLES FOR INDOOR USE:
- Standard - BT CW1308; BT CW1370; BT CW1700; and BT CW1750.
- Comply with the fire performance requirements of BS 6701 and BS EN 50575.
  - Ensure all standard communications cables that are intended for installation into pathways that are hidden below floors, behind walls, or to which access is limited, meet as a minimum BS EN 13501-6 EuroClass C_{ca}-s1b,d2,a2, or higher rating as indicated on the relevant cable schedule.
  - Ensure all other standard communications cables meet as a minimum BS EN 13501-6 EuroClass E_{ca}, or the requirements of BS EN 60332-1-2, or higher rating as indicated on the relevant cable schedule.

2080A STANDARD COAXIAL CABLES, FOR BROADCAST RECEIVING:
- Standard - BS EN 50117. CAI Benchmark status, cable types CT100, CT125, CT165.
- Comply with the fire performance requirements of BS 6701 and BS EN 50575.
  - Ensure all coaxial cables that are intended for installation into pathways that are hidden below floors, behind walls, or to which access is limited, meet as a minimum BS EN 13501-6 EuroClass C_{ca}-s1b,d2,a2, or higher rating as indicated on the relevant cable schedule.

- Ensure all other coaxial cables meet as a minimum BS EN 13501-6 EuroClass E_{ca}, or the requirements of BS EN 60332-1-2, or higher rating as indicated on the relevant cable schedule.

2080B STANDARD RADIATING COAXIAL CABLES (LEAKY FEEDER) FOR WIRELESS NETWORKING (WIFI):
- Standard
  - BS EN 61196-4
- Characteristic impedance
  - 50 Ohm
- Operating frequency
  - 2.4 GHz
  - 5.0 GHz.
- Comply with the fire performance requirements of BS 6701 and BS EN 50575.
  - Ensure all coaxial cables that are intended for installation into pathways that are hidden below floors, behind walls, or to which access is limited, meet as a minimum BS EN 13501-6 EuroClass C_{ca}-s1b,d2,a2, or higher rating as indicated on the relevant cable schedule.
  - Ensure all other coaxial cables meet as a minimum BS EN 13501-6 EuroClass E_{ca}, or the requirements of BS EN 60332-1-2, or higher rating as indicated on the relevant cable schedule.

2090A OPTICAL FIBRE CABLES:
- Standard - BS EN 60794-2-11 and BS EN 187103. Category of multimode fibre to
  - BS EN 60793-2-10:
    - A1a.1
    - A1a.2
    - A1a.3
    - A1b
    - A1c
    - A1d
- Fibre optic interconnecting devices and components to BS EN 61300, BS EN 62148, BS EN IEC 62148-1, BS EN 62664-1-1 and PD IEC/TR 62627-03-03
- Comply with the fire performance requirements of BS 6701 and BS EN 50575.
  - Ensure all optical fibre cables that are intended for installation into pathways that are hidden below floors, behind walls, or to which access is limited, meet as a minimum BS EN 13501-6 EuroClass C_{ca}-s1b,d2,a2, or higher rating as indicated on the relevant cable schedule.
  - Ensure all other optical cables meet as a minimum BS EN 13501-6 EuroClass E_{ca}, or the requirements of BS EN 60332-1-2, or higher rating as indicated on the relevant cable schedule.

2100A INFORMATION TECHNOLOGY CABLES - STRUCTURED WIRING: CATEGORY 5:
- Provide IT cables in accordance with the IT system suppliers specification.
- Type of system - structured cabling - relevant parts of BS EN 50173
- Standard - for Category 5 and Category 5e, BS EN 50288-3-1 and BS EN 50288-3-2
- Termination reference - EIA/TIA TSB-40.
- Cable construction - multi pair, unshielded (UTP).
- Comply with the fire performance requirements of BS 6701 and BS EN 50575.
  - Ensure all structured wiring category 5 cables meet as a minimum BS EN 13501-6 EuroClass C_{ca}-s1b,d2,a2, or higher rating as indicated on the relevant cable schedule.

2100C INFORMATION TECHNOLOGY CABLES - HBES CLASS 1:
- Provide IT cables in accordance with the IT systems suppliers specification.
- Type of system - HBES Class 1.
- Standard - BS EN 50090-9-1.
- Cable construction - 2 twisted pairs unshielded.
- Comply with the fire performance requirements of BS 6701 and BS EN 50575.
  - Ensure all HBES class 1 information technology cables meet as a minimum BS EN 13501-6 EuroClass C_{ca}-s1b,d2,a2, or higher rating as indicated on the relevant cable schedule.

2100D INFORMATION TECHNOLOGY CABLES - INDOOR MULTI-PAIR/QUAD RISER CABLES:
- Provide IT cables in accordance with IT system suppliers specification.
- Application - Multiple Dwelling Units (MDU) shaft supporting universal services, xDSL and applications up to 100 MBits over IP.
- Standard - BS EN 50407-3
- Type of system -
- Cable construction -
- Comply with the fire performance requirements of BS 6701 and BS EN 50575.
- Ensure all multipair riser cables meet as a minimum BS EN 13501-6 EuroClass C_{ca}-s1b,d2,a2, or higher rating as indicated on the relevant cable schedule.

2170 PRE-FABRICATED WIRING SYSTEMS - SYSTEM REQUIREMENTS AND MANUFACTURING:
- Standard:
  - The requirements for fixed wiring installations in accordance with BS 7671 (IET Wiring Regulations).
  - The safety requirements of BS 8488.
  - BS EN 61535 for installation couplers and distribution blocks.
  - BS EN 61984 for connectors associated with LV switchgear and controlgear to the relevant parts of BS EN 61439.
  - BS 5733 or the relevant parts of BS EN 61439 for connecting, terminating, coupling and branching points where BS EN 61535 is not applicable.
  - BS 6701 and BS EN 50174 series for assemblies incorporating information technology and similar cables.
  - Provide a pre-fabricated wiring system comprising:
    - Home run cables.
    - Master distribution boxes (MDB's).
    - Extender cables.
    - Connectors.
    - Fused tees.
    - Luminaire flexible tees.
  - Connectors
    - Ensure all connections with the exception of those to be terminated within the distribution boards are pre-terminated into 'snap-fit' plug and socket connectors.
    - Ensure distinct types of connectors (distinguished by both colour code and mating key) are used on MDB ports and extender cables to prevent circuits with different ratings or conflicting characteristics being interconnected.
    - Ensure connectors incorporate a locking mechanism to prevent accidental disconnection.
    - Ensure all terminations within connectors are maintenance free, screw-less and without terminal blocks.
    - Ensure that the ingress protection rating in accordance with BS EN 60529 offers at least:
      - IP31 in areas only accessible to skilled and instructed persons as defined in BS 7671 (IET Wiring Regulations).
      - IP41 in all other areas
  - Cables
    - Ensure cables are selected in accordance with BS 7671 (IET Wiring Regulations).
    - Ensure cables cater for grouping and other relevant correction factors required by BS 7671 (IET Wiring Regulations) based on the number of circuits and circuit ratings.
    - Ensure home run and extender cables incorporate separate circuit protective conductors for each circuit.
    - Ensure cable assemblies are the correct length between connections onto MDB's or outlets or equipment without intermediate connectors, extensions or excessive slack.
  - Ensure that sheaths of metallic sheathed systems are earthed and provide full 360-degree bonding onto the casing of the connectors.
  - Ensure pre-fabricated wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).
  - Where pre-fabricated wiring systems incorporate signal wiring for building control systems, information technology, or similar purposes, it shall be ensured that the type of signal cable used is suitable for the system protocol and combination with the LV circuit wiring.

- Ensure the assembly meets the safety requirements of BS 7671 (IET Wiring Regulations) for separation of different voltage bands, and the requirements of BS 7671 (IET Wiring Regulations) and BS EN 50174 series for segregation and separation for electromagnetic compatibility.
- Ensure the arrangements for signal cables maintain the required network topology and not exceed maximum network lengths.
- Ensure MDB's comprise a steel enclosure with output ports located around the perimeter, external fixing lugs shall be provided to prevent damage to the internal wiring.
- Ensure assemblies with high protective conductor currents comply with regulation group 543.7 of BS 7671 (IET Wiring Regulations).

3010A CABLES GLANDS - UNARMOURED CABLES, INDOORS:
- Cable type
  - Flexible; wiring and power; control and auxiliary; and communications.
- Standard - BS EN 62444 non-metallic, cable retention, IP54; Type A1 as BS 6121-5 Annex A..
- Environment - indoor.

3010B CABLES GLANDS - UNARMOURED CABLES, OUTDOORS:
- Cable type
  - Flexible; wiring and power; control and auxiliary; and communications.
- Standard - BS EN 62444 non-metallic, cable retention, IP54; Type A2 as BS 6121-5 Annex A.
- Environment - outdoor.

3010C CABLES GLANDS - ARMOURED CABLES, DRY INDOORS:
- Cable type
  - Wiring and power; and control and auxiliary.
- Standard - BS EN 62444 metallic, cable retention Class A, protective connection to earth, IP54. Type B as BS 6121-5 Annex A.
- Environment - dry indoors.

3010D CABLE GLANDS - ARMOURED CABLES, INDOORS:
- Cable type
  - Wiring and power; and control and auxiliary.
- Standard - BS EN 62444 metallic, cable retention Class A, protective connection to earth, IP54. Type B as BS 6121-5 Annex A.
- Environment - indoor.

3010E CABLE GLANDS - ARMOURED CABLES, OUTDOORS:
- Cable type
  - Wiring and power; and control and auxiliary.
- Standard - BS EN 62444 metallic, cable retention Class A, protective connection to earth, IP54 with shroud. Type C as BS 6121-5 Annex A.
- Environment - outdoor.

3020B CABLE SEALS - HEAVY AND LIGHT DUTY MINERAL INSULATED CABLES - PROTECTED 'E' FOR HAZARDOUS AREAS:
- Use seals for mineral insulated cables in accordance with BS EN 60702-2, recommended or supplied by cable manufacturer.
- Seal type
  - Plain; or earth tail and self-threading pot; or polymeric one piece.
- Pot closure - plastic disc.
- Pot sealant - epoxy putty.
- Conductor insulation sleeving - headed PTFE.
- Seal maximum temperature rating - 100°C or 85°C.
- Other seal characteristics
  - Certified to BS EN 60079-14 for hazardous areas, `e'.

3110A CABLE DUCTS:
- Standard

- BS 4660 provided by Electricity Distribution Company.

3120A CABLE SLEEVES:
- Supply and hand to others for installation non-ferrous cable sleeves for incorporation into the structure where cables pass through fire compartment floors and walls. Sleeving to be in accordance with BS EN 60684
- Packing material
  - Weak mix mortar; intumescent, plaster or mastic; solid intumescent material; or intumescent granule filled bags.

3130A CABLE COVERS AND MARKERS:
- Material - recovered plastic, integral tape.
  - Marking - electricity or telephone.
- Plastic marker tape
  - Yellow, marked electricity or telephone.

4010 CABLE INSTALLATION - GENERAL:
- Use and install cables only as directed in the appropriate standard or as directed by the manufacturer in writing. Lay cables in one length unless otherwise indicated. Obtain permission from supervising officer for all through joints, and where overall length requirement exceeds practical drum size.
- Handle, install and dispose of cables on wooden drums in accordance with BS 8512
- Install cables when ambient temperature is 5°C or greater, using cables stored at or above this temperature for not less than 24 hours.
- Use drum stands, drum axles, fair leads, rollers, cable stockings and other equipment as recommended by the cable manufacturer and as appropriate to the method of installation.
- Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4020 CABLE INSTALLATION IN LOW TEMPERATURES:
- Install cables at lower installation temperatures when authorised by manufacturer in a written statement.
- Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4030 INSTALLATION OF LSF CABLE:
- Install LSF cables in accordance with manufacturer's instructions. Ensure ambient temperature is above 5°C. Ensure oversheaths are not damaged by abrasion or scuffing.
- Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4030A INSTALLATION OF LSZH / LSOH CABLES:
- Install LSZH/LSOH cables in accordance with the manufacturer's instructions, ensuring the ambient temperatures are above the minimum specified by the manufacturer.
- Install LSZH/LSOH cables so that they are not exposed to concrete or other substances containing products similar to lime.
- Where LSZH/LSOH cables are installed outside containment, directly on concrete floors (e.g. under raised floors in offices, control rooms or data centres) ensure suitable cable mat products with appropriate fire performance are used.
- Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4040 INSTALLATION OF UNARMOURED CABLES:
- Install and use unarmoured cable to BS EN 50565-1, BS EN 50565-2, or the manufacturer's written instructions.
- Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4060 CABLE INSTALLATION IN TRENCHES:

- Lay cables on newly prepared bedding. Ensure multiple layers of cable are separated vertically by a 50mm layer of hard rammed bedding material.
- When using a power winch ensure tension on the cable is taken by element of the cable designed for that purpose, that is armour or conductor cores as appropriate and not plastic sheath, metal sheath or core insulation.
- When hand pulling cable ensure no kinks are formed and that flaking, when used, is done in the correct direction.
- Do not allow cable to twist during installation. Use swivels to connect pulling bond to cable stocking or equivalent fitting.
- Check drum is suitable for jacking before commencing installation. If drum or reel is unsuitable for jacking, flake cable in correct direction in maximum size turns from drum or reel before commencing installation. Use skilled labour to supervise all unreeling, flaking or running of cable from a drum.
- Lay cables in the formation shown, ensure spacing is not reduced below that indicated.
- Bind trefoil groups at 1m intervals. Bind any associated earth or protective conductor to its cable or trefoil group at 1m intervals.
- Space multiple cables in trenches in accordance with BS 7671.
- Ensure installation radii and permanent bending radii are not less than those recommended by the manufacturer.
- Do not lay cables to BS 7211 or BS EN 50525 direct in the ground.

4090A CABLE INSTALLATION IN CONDUIT AND TRUNKING:

- Install cables so that they are orderly and capable of being withdrawn.
- Arrange single core wiring generally using the loop-in method.
- Trunking
  - In vertical trunking provide pin racks at 3m intervals. Use ties at 2m intervals for all wires of the same circuit reference. Mark ties with circuit reference number at 10m intervals.
- Conduit
  - Provide cable clamps in conduit boxes at 10m intervals in vertical conduit.
  - Allow for full range of movement at building construction movement joints. Make all joints to wiring at terminal blocks in conduit boxes.
- Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4110A CABLE SURFACE INSTALLATION:

- Dress cables flat, free from twists, kinks and strain; and align parallel to building elements. When glands and clamps are not required, take sheathing of cables into accessory boxes and equipment and protect against abrasion using grommets or similar sharp edge protection.
- Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4120A CABLE EMBEDDED INSTALLATION:

- Dress cables flat, free from twists, kinks and strain; and align parallel to building elements. When glands and clamps are not required, take sheathing of cables into accessory boxes and equipment and protect against abrasion using grommets or similar sharp edge protection.
- Ensure plaster or screed over cable is a minimum of 12mm. Protect embedded cables with metal capping or PVC oval conduit.

4130A CABLE INSTALLATION - MINERAL INSULATED CABLES:

- Straighten and dress cables using methods and tools recommended by cable manufacturer.
- Use thermoplastic or LSF sheathed cables in location indicated, and where cables may come into direct contact with any material that may be corrosive to copper.
- Do not allow extra length on installed cables to allow for cutting back of moisture affected ends. Store mineral insulated cables in the form as supplied by manufacturer.
- Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4140 CABLE INSTALLATION - FLEXIBLE CORDS:

- Grip cords securely at connections. Where they do not form an integral part of the connected accessory or equipment, provide separate proprietary cord grips.
- Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).
- Ensure that any cables not sitting on the top surface of a cable rack or tray are secured so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4150A CABLE JOINTING AND TERMINATING GENERALLY:

- Ensure all joints and terminations are made by appropriately qualified cable jointers, using jointing materials, components and workmanship recommended by the cable manufacturer and the jointing accessory manufacturer. Install cable glands in accordance with BS 6121-5
  - Cold pour resin and heat shrink joints.
  - Cut all cable ends immediately prior to jointing or terminating. Seal cables left unconnected for more than 24 hours to prevent the ingress of moisture. Seal plastic sheathed cables using proprietary shrink on end caps. Seal lead sheathed cables by a plumbed dressed lead cap with an airspace to allow conductor movement.
- Strip cables to bring out the cores and expose conductors, for the minimum length required for connection, to leave no exposed length of conductor after termination. Ensure that strands are not damaged when stripping cable cores. Twist strands together. Do not reduce number of strands. Secure all strands at terminations.
- Clean armour thoroughly prior to jointing or terminating.
- At connections to equipment and switchgear without integral cable clamping terminals, use compression or solder type lugs for bolted terminal connections, of correct bore.
- Form all compression connections to components using tools that cannot be released unless the correct degree of compression has been achieved.
  - Install and inspect compression and mechanical connectors on conductors in accordance with BS EN 60228 and BS 7609
- Bolt core terminations with lugs to equipment using washers or proprietary shakeproof devices.
- Do not bunch more than three cores at clamping terminals or bolted connections.
- Mark cable conductor phasing or other core identification at each end of all cables; and at all joints maintaining consistency of marking with any existing system.
- Connect all cores, including multicore cable spare cores, at all joints and terminations. Bond any unused cores or multicore cables to earth at both ends, unless otherwise indicated.

4180A TERMINATING - MINERAL INSULATED CABLES:

- Use terminations in accordance with BS EN 60702-2 and components and materials recommended or supplied by cable manufacturer.
- Use seals with maximum temperature rating indicated stub caps to the largest size available; and drilled caps and headed sleeves for larger sizes.
- Use glands of type indicated. At terminations to accessory boxes within a plaster or render finish, cable clamps fixed to accessory box and firmly gripping cable sheath may be used. Use earth tail seals with sheath grip type accessory boxes.
- At equipment not provided with threaded entries secure glands using lock washers and locknuts or brass conduit bush. Use gland shrouds when plastic covered MI cables are used.
- Using PVC, PIB or LSF material tape to BS EN 60454 to match sheath, tape overall gland any bare copper sheath and form seal to cable sheath under all shrouds.
- Mark core sleeving with appropriate identification.
- Install voltage surge suppressors in accordance with manufacturer's recommendations and surge suppressors to BS 7671, Section 331-01-01.

4190A CABLE JOINTS - MINERAL INSULATED CABLES:

- Joint mineral insulated cables using methods and materials recommended by cable manufacturer. Terminate cables in externally threaded glands using seals with temperature rating indicated. Join conductors using crimped connectors.
- Insulate connectors using PVC tape to BS EN 60454, ensuring good seal to conductor sleeving. Make off glands into either end of internally threaded brass sleeve of correct size. Protect brass sleeve using heat shrink sleeve.

4200A COMMUNICATIONS COAXIAL, OPTICAL FIBRE AND IT CABLE INSTALLATION, JOINTING AND TERMINATING:

- Use methods approved by cable and accessory manufacturers.
- Use methods of fixing and restraint which do not deform the cross-section of cables, which might otherwise affect the data / signal performance of cables.
- Ensure cable protection mats are used in basket in which unarmoured copper cables are installed, where cable deformation may affect signal / data performance (e.g. Category 6 and Category 6a applications).
- Employ labour certified by acceptable body as qualified to install and make joints and terminations in the referenced cable. Obtain in writing approval of cable manufacturer for accessories not supplied by them.
- Identify cables using structured numbering scheme.
- Install communication, coaxial, optical fibre and IT cables in accordance with BS EN 50174-2 and BS EN 50174-3.
- Ensure wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).
- Ensure that any cables not sitting on the top surface of a cable rack or tray are secured so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).

4210 CABLE INSTALLATION - PRE-FABRICATED WIRING SYSTEMS:

- Ensure that the manufacturer prepares drawings, detailing the installation and identifying each component of the pre-fabricated wiring system, and its location.
- Ensure connectors are only installed in dry environments, and not within wet areas such as showers and bathrooms.
- Ensure connections are located such that they are accessible after all works are completed, for maintenance and inspection and testing.
- Ensure home run cables are fixed directly to the soffit. Where groups of 2 or more cables are run together these shall be run on cable baskets or trays.
- Ensure extender cables are clipped to the soffit or structural elements, independent of ceiling supports.
- Ensure pre-fabricated wiring systems are supported so that they are not liable to premature collapse in the event of a fire, in accordance with BS 7671 (IET Wiring Regulations).
- Ensure home run and extender cables are installed such that they are supported clear from the ceiling and run along the lines of the ceiling grid so that they do not restrict access to the ceiling void or other services.
- Ensure all cables without mechanical protection suitable to protect against penetrate by screws, nails and similar, or without protection by and earthed metallic armour or sheath rated as protective conductor for the circuits enclosed, and installed within partitions are routed in accordance with permitted cable routes and, if installed at a depth of less than 50 mm, protected by a 30 mA RCD, in accordance with BS 7671 (IET Wiring Regulations).
- Ensure un-used connectors are fitted with end caps.
- Ensure all connectors in which protective conductor currents may exceed 10 mA have a label complying with BS EN ISO 7010, incorporating safety sign W012 (electricity warning triangle with lightning bolt) with the following words in black on a yellow background: "WARNING. HIGH PROTECTIVE CONDUCTOR CURRENTS. ISOLATE CIRCUIT BEFORE DISCONNECTING."
- Cables are to be continuity and polarity tested at the works and each passed cable assembly is to be serial numbered with the recorded data detailed on the product. Once integrated into the works the pre-fabricated wiring shall be re-tested as part of the initial verification of the fixed installation in accordance with BS 7671 (IET Wiring Regulations).

BS APPENDIX

BS 4660:2000
Thermoplastics ancillary fittings of nominal sizes 110 and 160 for below ground gravity drainage and sewerage.

BS 5266-1:2016

Emergency lighting. Part 1: Code of practice for the emergency lighting of premises

BS 5467:2016
Electric cables. Thermosetting insulated, armoured cables of rated voltages of 600/1000 V and 1900/3300 V for fixed installations. Specification

BS 5733:2010+A1:2014
General requirements for electrical accessories. Specification

BS 5839-1:2017
Fire detection and fire alarm systems for buildings. Part 1 Code of practice for design, installation, commissioning and maintenance of systems in non-domestic premises

BS 6004:2012
Electric cables. PVC insulated and PVC sheathed cables for voltages up to and including 300/500 V, for electric power and lighting

BS 6121-5:2005
Mechanical cable glands. Part 5 Code of practice for selection, installation and inspection of cable glands and armour glands

BS 6231:2006
Electric cables. Single core PVC insulated flexible cables of rated voltage 600/1000V for switchgear and controlgear wiring.

BS 6469-99-1:1992
Insulating and sheathing materials of electric cables. Test methods used in the United Kingdom but not specified in BS EN 60811. Non-electrical tests

BS 6469-99.2:1992
Insulating and sheathing materials of electric cables. Test methods used in the United Kingdom but not specified in BS EN 60811. Electrical tests

BS 6622:2007
Electric cables. Armoured cables with thermosetting insulation for rated voltages from 3.8/6.6 kV to 19/33 kV. Requirements and test methods.

BS 6701:2016+A1:2017
Telecommunications equipment and telecommunications cabling. Specification for installation, operation and maintenance

BS 6708:1998
Flexible cables for use at mines and quarries

BS 6724:2016
Electric cables. Thermosetting insulated, armoured cables of rated voltages of 600/1000 V and 1900/3300 V for fixed installations, having low emission of smoke and corrosive gases when affected by fire. Specification

BS 7211:2012
Electric cables. Thermosetting insulated and thermoplastic sheathed cables for voltages up to and including 450/750 V, for electric power and lighting and having low emission of smoke and corrosive gases when affected by fire

BS 7609:1992+A2:2009
Code of practice for installation and inspection of uninsulated compression and mechanical connectors for power cables with copper or aluminium conductors

BS 7629-1:2015
Electric cables. Specification for 300/500 V fire resistant, screened, fixed installation cables having low

emission of smoke and corrosive gases when affected by fire. Part 1 Multicore cables

BS 7655-0:2006
Specification for insulating and sheathing materials for cables. Part 0 General introduction

BS 7655-1.2:1997
Specification for insulating and sheathing materials for cables. Cross-linked elastomeric insulating compounds. General 90°C application

BS 7655-1.3:2000
Specification for insulating and sheathing materials for cables. Elastomeric insulating compounds. XLPE. Sec1.3 XLPE

BS 7655-1.5:2000
Specification for insulating and sheathing materials for cables. Cross-linked elastomeric insulating compounds. Flame retardant composites

BS 7655-2.3:2000
Specification for insulating and sheathing materials for cables. Elastomeric sheathing compounds. General application. General application

BS 7655-2.6:2000
Specification for insulating and sheathing materials for cables. Cross-linked elastomeric sheathing compounds. Sheathing compounds for ships' wiring and offshore applications

BS 7655-3.2:2000
Specification for insulating and sheathing materials for cables. PVC insulating compounds. Hard grade types. Hard grade types

BS 7655-4.2:2000
Specification for insulating and sheathing materials for cables. PVC sheathing compounds. General application. General application

BS 7655-6.1:1997
Specification for insulating and sheathing materials for cables. Part 6.1 Thermoplastic sheathing compounds having low emission of corrosive gases, and suitable for use in cables having low emission of smoke when affected by fire. General application thermoplastic types

BS 7655-10.1:2000
Specification for insulating and sheathing materials for cables. Polyethylene sheathing compounds. Thermoplastic medium density polyethylene (MDPE) sheathing compound

BS 7671:2018
Requirements for electrical installations. IET Wiring Regulations

BS 7835:2007
Electric cables. Armoured cables with thermosetting insulation for rated voltages from 3.8/6.6kV to 19/33 kV having low emission of smoke and corrosive gases when affected by fire. Requirements and test methods

BS 7870-1:2011
LV and MV polymeric insulated cables for use by distribution and generation utilities. General

BS 7870-2:2011
LV and MV polymeric insulated cables for use by distribution and generation utilities. Methods of test

BS 7870-3.10:2001
LV and MV polymeric insulated cables for use by distribution and generation utilities. Specification for distribution cables of rated voltage 0.6/1 kV. PVC insulated combined neutral and earth copper wire concentric cables with copper or aluminium conductors

BS 7870-3.11:2011
LV and MV polymeric insulated cables for use by distribution and generation utilities. Specification for distribution cables of rated voltage 0.6/1 kV. XLPE insulated combined neutral and earth copper wire concentric cables with copper or aluminium conductors

BS 7870-3.12:2011
LV and MV polymeric insulated cables for use by distribution and generation utilities. Part 3.12 Specification for distribution cables of rated voltage 0.6/1 kV. XLPE insulated combined neutral and earth copper wire concentric cables with copper or aluminium conductors, having low emission of smoke and corrosive gases when affected by fire

BS 7870-3.20:2001
LV and MV polymeric insulated cables for use by distribution and generation utilities. Part 3.20 Specification for distribution cables of rated voltage 0.6/1 kV. PVC insulated split concentric cables with copper or aluminium conductors

BS 7870-3.21:2011
LV and MV polymeric insulated cables for use by distribution and generation utilities. Part 3.21 Specification for distribution cables of rated voltage 0.6/1 kV. XLPE insulated split concentric cables with copper or aluminium conductors

BS 7870-3.22:2011
LV and MV polymeric insulated cables for use by distribution and generation utilities. Specification for distribution cables of rated voltage 0.6/1 kV. XLPE insulated split concentric cables with copper or aluminium conductors, having low emission of smoke and corrosive gases when affected by fire

BS 7870-3.40:2011
LV and MV polymeric insulated cables for use by distribution and generation utilities. Part 3.40 Specification for distribution cables of rated voltage 0.6/1 kV. XLPE insulated, copper wire waveform concentric cables with solid aluminium conductors

BS 7870-3.50:2011
LV and MV polymeric insulated cables for use by distribution and generation utilities. Specification for distribution cables of rated voltage 0.6/1 kV. Part 3.50 XLPE insulated, copper wire waveform or helical concentric cables with solid aluminium conductors, having low emission of smoke and corrosive gases when affected by fire

BS 7870-4.10:2011+A1:2016
LV and MV polymeric insulated cables for use by distribution and generation utilities. Part 4.10 Specification for distribution cables with extruded insulation for rated voltages of 11 kV and 33 kV. Single-core 11 kV and 33 kV cables (Implementation of HD 620)

BS 7870-4.11:2011+A1:2016
LV and MV polymeric insulated cables for use by distribution and generation utilities. Specification for distribution cables with extruded insulation for rated voltages of 11 kV and 33 kV. Single-core 33 kV lead sheathed cables (Implementation of HD 620)

BS 7870-4.20:2011+A1:2016
LV and MV polymeric insulated cables for use by distribution and generation utilities. Part 4.20 Specification for distribution cables with extruded insulation for rated voltages of 11 kV and 33 kV. Three-core 11 kV cables (Implementation of HD 620)

BS 7870-5:2011
LV and MV polymeric insulated cables for use by distribution and generation utilities. Polymeric insulated aerial bundled conductors (ABC) of rated voltage 0.6/1 kV for overhead distribution

BS 7870-8.1:2003
LV and MV polymeric insulated cables for use by distribution and generation utilities. Specification for multicore and multipair cables for installation above and below ground. Single wire armoured and PVC

sheathed multicore cable with copper conductors. Section 8.1 Single wire armoured and PVC sheathed multicore cable with copper conductors

BS 7870-8.2:2003
LV and MV polymeric insulated cables for use by distribution and generation utilities. Specification for multicore and multipair cables for installation above and below ground. Single wire armoured and PVC sheathed multipair cable with copper conductors. Section 8.2 Single wire armoured and PVC sheathed multipair cable with copper conductors

BS 7870-8.3:2003
LV and MV polymeric insulated cables for use by distribution and generation utilities. Specification for multicore and multipair cables for installation above and below ground. Single wire armoured and PVC sheathed multicore cable with copper conductors, having reduced fire propagation performance. Section 8.3 Single wire armoured and PVC sheathed multicore cable with copper conductors, having reduced fire propagation performance

BS 7870-8.4:2003
LV and MV polymeric insulated cables for use by distribution and generation utilities. Specification for multicore and multipair cables for installation above and below ground. Single wire or double steel tape armoured and PVC sheathed multipair cable with copper conductors, having reduced fire propagation performance. Section 8.4 Single wire or double steel tape armoured and PVC sheathed multipair cable with copper conductors, having reduced fire propagation performance

BS 7870-8.5:2003
LV and MV polymeric insulated cables for use by distribution and generation utilities. Specification for multicore and multipair cables for installation above and below ground. Single wire armoured and unarmoured multicore cables with copper conductors and non-halogenated sheath. Section 8.5 Single wire armoured and unarmoured multicore cables with copper conductors and non-halogenated sheath

BS 7870-8.6:2003
LV and MV polymeric insulated cables for use by distribution and generation utilities. Specification for multicore and multipair cables for installation above and below ground. Single wire or double steel tape armoured and non-halogenated sheathed multipair cable with copper conductors. Section 8.6 Single wire or double steel tape armoured and non-halogenated sheathed multipair cable with copper conductors

BS 8436:2011
Electric cables. Specification for 300/500 V screened electric cables having low emission of smoke and corrosive gases when affected by fire, for use in walls, partitions and building voids. Multicore cables

BS 8488:2009+A1:2010
Prefabricated wiring systems intended for permanent connection in fixed installations. Specification

BS 8512:2008
Electric cables. Code of practice for the storage, handling, installation and disposal of cables on wooden drums

BS 8592:2016
Electric cables. Thermosetting insulated, non-armoured, fire-resistant, single core non-sheathed cables of rated voltage 450/750 V, having low emission of smoke and corrosive gases when affected by fire. Specification

BS EN 10257-1:2011
Zinc or zinc alloy coated non-alloy steel wire for armouring either power cables or telecommunication cables. Land cables

BS EN 12548:1999
Lead and alloys. Lead alloy ingots for electric cable sheathing and for sleeves

BS EN 13501-6:2014
Fire classification of construction products and building elements. Classification using data from reaction to fire tests on electric cables

BS EN 50090-9-1:2004
Home and building electronic systems (HBES). Part 9-1 Installation requirements. Generic cabling for HBES class 1 twisted pair

BS EN 50117-1:2002+A2:2013
Coaxial cables. Generic specification

BS EN 50117-2-1:2005+A2:2013
Coaxial cables. Part 2-1 Sectional specification for cables used in cabled distribution networks. Indoor drop cables for systems operating at 5 MHz - 1000 MHz

BS EN 50117-2-2:2004+A2:2013
Coaxial cables. Part 2-2 Sectional specification for cables used in cabled distribution networks. Outdoor drop cables for systems operating at 5 MHz - 1000 MHz

BS EN 50117-2-3:2004+A2:2013
Coaxial cables. Part 2-3 Sectional specification for cables used in cabled distribution networks. Distribution and trunk cables for systems operating at 5 MHz - 1000 MHz

BS EN 50117-2-4:2004+A2:2013
Coaxial cables. Part 2-4 Sectional specification for cables used in cabled distribution networks. Indoor drop cables for systems operating at 5 MHz - 3000 MHz

BS EN 50117-2-5:2004+A2:2013
Coaxial cables. Part 2-5 Sectional specification for cables used in cabled distribution networks. Outdoor drop cables for systems operating at 5 MHz - 3000 MHz

BS EN 50117-3-1:2002
Coaxial cables. Part 3-1 Sectional specifications for cables used in telecom applications. Miniaturized cables used in digital communication systems

BS EN 50117-3:1996
Coaxial cables used in cabled distribution networks. Part 3 Sectional specification for outdoor drop cables

BS EN 50117-4-1:2008+A1:2013
Coaxial cables. Sectional specification for cables for BCT cabling in accordance with EN 50173. Indoor drop cables for systems operating at 5 MHz - 3 000 MHz

BS EN 50117-4-2:2015
Coaxial cables. Sectional specification for CATV cables up to 6 GHz used in cabled distribution networks

BS EN 50117-4:1996
Coaxial cables used in cabled distribution networks. Part 4 Sectional specification for distribution and trunk cables

BS EN 50117-5:1997
Coaxial cables used in cabled distribution networks. Part 5 Sectional specification for indoor drop cables for use in networks operating at frequencies between 5 MHz and 2150 MHz

BS EN 50117-6:1997
Coaxial cables used in cabled distribution networks. Part 6 Sectional specification for outdoor drop cables for use in networks operating at frequencies between 5 MHz and 2150 MHz

BS EN 50173-1:2018

Information technology. Generic cabling systems. Part 1 General requirements

BS EN 50173-2:2018
information technology. Generic cabling systems. Part 2: Office spaces

BS EN 50173-3:2018
information technology. Generic cabling systems. Part 3: Industrial spaces

BS EN 50173-4:2018
information technology. Generic cabling systems. Part 4 Homes

BS EN 50173-5:2018
information technology. Generic cabling systems. Part 5 Data centre spaces

BS EN 50173-6:2018
Information technology. Generic cabling systems. Distributed building services

BS EN 50174-1:2018
Information technology. Cabling installation. Installation specification and quality assurance

BS EN 50174-2:2018
Information technology. Cabling installation. Installation planning and practices inside buildings

BS EN 50174-2:2018
Information technology. Cabling installation. Installation planning and practices inside buildings

BS EN 50174-3:2013+A1:2017
Information technology. Cabling installation. Part 3 Installation planning and practices outside buildings

BS EN 50174-3:2013+A1:2017
Information technology. Cabling installation. Part 3 Installation planning and practices outside buildings

BS EN 50214:2006
Flat polyvinyl chloride sheathed flexible cables

BS EN 50288-3-1:2013
Multi-element metallic cables used in analogue and digital communication and control. Part 3-1 Sectional specification for unscreened cables characterized up to 100 MHz. Horizontal and building backbone cables

BS EN 50288-3-2:2013
Multi-element metallic cables used in analogue and digital communication and control. Part 3-2 Sectional specification for unscreened cables characterized up to 100 MHz. Work area and patch cord cables

BS EN 50288-7:2005
Multi-element metallic cables used in analogue and digital communication and control. Part 7 Sectional specification for instrumentation and control cables

BS EN 50290-2-21:2002
Communication cables. Part 2-21 Common design rules and construction. PVC insulation compounds

BS EN 50290-2-22:2002
Communication cables. Part 2-22 Common design rules and construction. PVC sheathing compounds

BS EN 50290-2-23:2013
Communication cables. Part 2-23 Common design rules and construction. Polyethylene insulation for multi-pair cables used in access telecommunication networks: Outdoor cables

BS EN 50290-2-24:2002+A1:2008
Communication cables. Common design rules and construction. PE sheathing

BS EN 50290-2-25:2013
Communication cables. Part 2-25 Common design rules and construction. Polypropylene insulation compounds

BS EN 50290-2-26:2002
Communication cables. Part 2-26 Common design rules and construction. Halogen free flame retardant insulation compounds

BS EN 50290-2-27:2002+A1:2007
Communication cables. Common design rules and construction. Halogen free flame retardant thermoplastic sheathing compounds

BS EN 50290-2-28:2002
Communication cables. Part 2-28 Common design rules and construction. Filling compounds for filled cables

BS EN 50290-2-29:2002
Communication cables. Part 2-29 Common design rules and construction. Cross-linked PE insulation compounds

BS EN 50290-2-30:2002
Communication cables. Part 2-30 Common design rules and construction. Poly(tetrafluoroethylene-hexafluoropropylene) (FEP) insulation and sheathing

BS EN 50334:2001
Marking by inscription for the identification of cores of electric cables

BS EN 50363-0:2011
Insulating, sheathing and covering materials for low voltage energy cables. General introduction

BS EN 50363-1:2005
Insulating, sheathing and covering materials for low-voltage energy cables. Cross-linked elastomeric insulating compounds

BS EN 50363-2-1:2005+A1:2011
Insulating, sheathing and covering materials for low-voltage energy cables. Cross-linked elastomeric sheathing compounds

BS EN 50363-2-2:2005
Insulating, sheathing and covering materials for low voltage energy cables. Part 2-2 Cross-linked elastomeric covering compounds

BS EN 50363-3:2005+A1:2011
Insulating, sheathing and covering materials for low voltage energy cables. PVC insulating compounds

BS EN 50363-4-1:2005
Insulating, sheathing and covering materials for low voltage energy cables. Part 4-1 PVC sheathing compounds

BS EN 50363-4-2:2005
Insulating, sheathing and covering materials for low-voltage energy cables. PVC covering compounds

BS EN 50363-5:2005+A1:2011
Insulating, sheathing and covering materials for low voltage energy cables. Halogen-free, cross-linked insulating compounds

BS EN 50363-6:2005+A1:2011
Insulating, sheathing and covering materials for low-voltage energy cables. Halogen-free, cross-linked sheathing compounds

BS EN 50363-7:2005
Insulating, sheathing and covering materials for low voltage energy cables. 7 Halogen-free, thermoplastic insulating compounds

BS EN 50363-8:2005+A1:2011
Insulating, sheathing and covering materials for low voltage energy cables. Part 8 Halogen-free, thermoplastic sheathing compounds

BS EN 50363-9-1:2005
Insulating, sheathing and covering materials for low-voltage energy cables. Part 9-1 Miscellaneous insulating compounds. Cross-linked polyvinyl chloride (XLPVC)

BS EN 50363-10-1:2005
Insulating, sheathing and covering materials for low-voltage energy cables. Part 10-1 Miscellaneous sheathing compounds. Cross-linked polyvinyl chloride (XLPVC)

BS EN 50363-10-2:2005
Insulating, sheathing and covering materials for low-voltage energy cables. Part 10-2 Miscellaneous sheathing compounds. Thermoplastic polyurethane

BS EN 50377-2-1:2001
Connectors sets and interconnect components to be used in optical fibre communication systems. Part 2-1 Product specifications. Type FC-PC terminated on IEC 60793-2 category B1 singlemode fibre

BS EN 50377-2-2:2009
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. FC/APC 8 terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre, with full zirconia ferrule, category C

BS EN 50377-3-1:2008
Connectors sets and interconnect components to be used in optical fibre communication systems. Part 3-1 Product specifications. Type SG terminated on IEC 6 0793-2 category A1a and A1b or equivalent multimode fibre for category C

BS EN 50377-4-2:2011
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type SC/APC simplex 8° terminated on IEC 60793-2-50 of types B1.1 and B1.3 singlemode fibre, with full zirconia ferrule category U

BS EN 50377-4-4:2011
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type SC-PC simplex terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre, with full zirconia ferrule category U

BS EN 50377-5-1:2003
Connectors sets and interconnect components to be used in optical fibre communication systems. Part 5-1 Product specifications. Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type EC terminated on IEC 60793-2 category B.1.1 singlemode fibre

BS EN 50377-6-1:2002
Connectors sets and interconnect components to be used in optical fibre communication systems. Part 6-1 Product specifications. Type SC-RJ terminated on IE C 60793-2 category A1a and A1b multimode fibre

BS EN 50377-6-2:2007

Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. SC-RJ single mode terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre, category U

BS EN 50377-7-1:2004
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type LC-PC duplex terminated on IEC 60793-2 category A1a and A1b multimode fibre

BS EN 50377-7-2:2004
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. LC-PC duplex terminated on IEC 60793-2 category B1.1 singlemode fibre

BS EN 50377-7-3:2004
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type LC-APC duplex terminated on IEC 60793-2 category B1.1 singlemode fibre

BS EN 50377-7-4:2011
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. LC-PC simplex terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre with full zirconia ferrule for category C

BS EN 50377-8-2:2007
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type LSH-APC simplex terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre, composite ferrule category C

BS EN 50377-8-3:2007
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. LSH-PC simplex terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre, composite ferrule category C

BS EN 50377-8-4:2007
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. LSH-APC simplex terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre, composite ferrule category U

BS EN 50377-8-5:2007
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. LSH-PC simplex terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre, composite ferrule category U

BS EN 50377-8-6:2007
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. LSH-HR simplex terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre, with full zirconia ferrule category C

BS EN 50377-8-7:2007
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. LSH-PC terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre, with full zirconia ferrule category C

BS EN 50377-8-8:2007
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. LSH-APC simplex terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre, with full zirconia ferrule category U

BS EN 50377-8-9:2007
Connector sets and interconnect components to be used in optical fibre communication systems.

Product specifications. LSH-PC simplex terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre, with full zirconia ferrule category U

BS EN 50377-8-10:2010
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type LSH-APC simplex terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre with titanium composite ferrule for category C

BS EN 50377-8-11:2010
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type LSH-PC simplex terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre with titanium composite ferrule for category C

BS EN 50377-8-12:2010
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type LSH-APC simplex terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre with titanium composite ferrule for category U

BS EN 50377-8-13:2010
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type LSH-PC simplex terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre with titanium composite ferrule for category U

BS EN 50377-9-1:2003
Connectors sets and interconnect components to be used in optical fibre communication systems. Product specifications. Part 9-1 Type MT-RJ terminated on IEC 60793-2 category A1a and A1b multimode fibre

BS EN 50377-9-2:2004
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type MT-RJ terminated on IEC 60793-2 category B1.1 singlemode fibre

BS EN 50377-10-1:2007
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type MU-PC simplex terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre, with full zirconia ferrule category C

BS EN 50377-10-2:2005
Connectors sets and interconnect components to be used in optical fibre communication systems. Product specifications. MU/APC singlemode terminated on IEC 60793-2 category B1 fibre

BS EN 50377-11-1:2008
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type MF terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre for category C

BS EN 50377-13-2:2011
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type LX.5-PC DUPLEX terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre, with full zirconia ferrule category U

BS EN 50377-13-3:2011
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type LX.5-APC DUPLEX terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre, with full zirconia ferrule category U

BS EN 50377-14-1:2011
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Cords with IEC 60793-2-50 singlemode category B1.1 and B1.3 fibre for category C

BS EN 50377-15-1:2011
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type MPO with 12-fibre PPS ferrules terminated on IEC 60793-2 category A1a multimode fibre for 50/125 micron multimode fibre

BS EN 50377-16-1:2011
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type LF3 APC simplex terminated on IEC 60793-2-50 category B1.1 and B1.3 singlemode fibre with titanium composite ferrule for category C

BS EN 50377-17-1:2013
Connector sets and interconnect components to be used in optical fibre communication systems. Product specifications. Type FPFT (factory polished field terminated) simplex connector factory terminated with EN 60793-2-50 category B1.3 fibre and field mounted onto IEC 60793-2-50 category B1.3 or B6a_1 or B6a_2 singlemode fibre, category C

BS EN 50377-17-2:2015
Connector sets and Interconnect components to be used in optical fibre communication systems. Product specifications. Type FPFT (factory polished field terminated) simplex connector factory terminated with EN 60793-2-50 category B1.3 fibre and field mounted onto reinforced cable containing IEC 60793-2-50 category B1.3 or B6a1 or B6a 2 singlemode fibre (with restricted MFD), category C

BS EN 50407-3:2014
Multi-pair cables used in high bit rate digital access telecommunications networks. Indoor multi-pair/quad riser cables up to 100 MHz for maximum length of connection 100 m supporting universal services, xDSL and applications up to 100 Mbit/s over IP

BS EN 50525-1:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). General requirements

BS EN 50525-2-11:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750V (U0/U). Cables for general applications. Flexible cables with thermoplastic PVC insulation

BS EN 50525-2-12:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Cables with thermoplastic PVC insulation for extensible leads

BS EN 50525-2-21:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Flexible cables with crosslinked elastomeric insulation

BS EN 50525-2-22:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. High flexibility braided cables with crosslinked elastomeric insulation

BS EN 50525-2-31:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Single core non-sheathed cables with thermoplastic PVC insulation

BS EN 50525-2-31:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Single core non-sheathed cables with thermoplastic PVC insulation

BS EN 50525-2-41:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Single core cables with crosslinked silicone rubber insulation

BS EN 50525-2-42:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Single core non-sheathed cables with crosslinked EVA insulation

BS EN 50525-2-51:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Oil resistant control cables with thermoplastic PVC insulation

BS EN 50525-2-71:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Flat tinsel cables (cords) with thermoplastic PVC insulation

BS EN 50525-2-72:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Flat divisible cables (cords) with thermoplastic PVC insulation

BS EN 50525-2-81:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Cables with crosslinked elastomeric covering for arc welding

BS EN 50525-2-82:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Cables with crosslinked elastomeric insulation for decorative chains

BS EN 50525-2-83:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables for general applications. Multicore cables with crosslinked silicone rubber insulation

BS EN 50525-3-11:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables with special fire performance. Flexible cables with halogen-free thermoplastic insulation, and low emission of smoke

BS EN 50525-3-21:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables with special fire performance. Flexible cables with halogen-free crosslinked insulation, and low emission of smoke

BS EN 50525-3-31:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables with special fire performance. Single core non-sheathed cables with halogen-free thermoplastic insulation, and low emission of smoke

BS EN 50525-3-41:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables with special fire performance. Single core non-sheathed cables with halogen-free crosslinked insulation, and low emission of smoke

BS EN 50525-3-41:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables with special fire performance. Single core non-sheathed cables with halogen-free crosslinked insulation, and low emission of smoke

BS EN 50565-1:2014
Electric cables. Guide to use for cables with a rated voltage not exceeding 450/750 V (U0/U). General guidance

BS EN 50565-2:2014
Electric cables. Guide to use for cables with a rated voltage not exceeding 450/750 V (U0/U). Specific

guidance related to EN 50525 cable types

BS EN 50575:2014+A1:2016
Power, control and communication cables. Cables for general applications in construction works subject to reaction to fire requirements

BS EN 60079-14:2014
Explosive atmospheres. Electrical installations design, selection and erection

BS EN 60228:2005
Conductors of insulated cables

BS EN 60332-1-1:2004+A1:2015
Tests on electric and optical fibre cables under fire conditions. Part 1-1 Test for vertical flame propagation for a single insulated wire or cable. Apparatus

BS EN 60332-1-2:2004+A11:2016
Tests on electric and optical fibre cables under fire conditions. Part 1-2 Test for vertical flame propagation for a single insulated wire or cable. Procedure for 1 kW pre-mixed flame

BS EN 60332-1-2:2004+A11:2016
Tests on electric and optical fibre cables under fire conditions. Part 1-2 Test for vertical flame propagation for a single insulated wire or cable. Procedure for 1 kW pre-mixed flame

BS EN 60332-1-3:2004+A1:2015
Tests on electric and optical fibre cables under fire conditions. Part 1-3 Test for vertical flame propagation for a single insulated wire or cable. Procedure for determination of flaming droplets/particles

BS EN 60332-2-1:2004
Tests on electric and optical fibre cables under fire conditions. Part 2-1 Tests for vertical flame propagation for a single small insulated wire or cable. Apparatus

BS EN 60332-2-2:2004
Tests on electric and optical fibre cables under fire conditions. Part 2-2 Tests for vertical flame propagation for a single small insulated wire or cable. Procedure for diffusion flame

BS EN 60332-3-10:2009
Tests on electric and optical fibre cables under fire conditions. Test for vertical flame spread of vertically-mounted bunched wires or cables. Apparatus

BS EN 60332-3-21:2009
Tests on electric and optical fibre cables under fire conditions. Test for vertical flame spread of vertically-mounted bunched wires or cables. Category A F/R

BS EN 60332-3-22:2009
Tests on electric and optical fibre cables under fire conditions. Test for vertical flame spread of vertically-mounted bunched wires or cables. Category A

BS EN 60332-3-23:2009
Tests on electric and optical fibre cables under fire conditions. Test for vertical flame spread of vertically-mounted bunched wires or cables. Category B

BS EN 60332-3-24:2009
Tests on electric and optical fibre cables under fire conditions. Test for vertical flame spread of vertically-mounted bunched wires or cables. Category C

BS EN 60332-3-25:2009
Tests on electric and optical fibre cables under fire conditions. Test for vertical flame spread of vertically-mounted bunched wires or cables. Category D

BS EN 60454-1:1995
Specifications for pressure-sensitive adhesive tapes for electrical purposes. Part 1 General requirements

BS EN 60454-2:2007
Pressure-sensitive adhesive tapes for electrical purposes. Methods of test

BS EN 60454-3-1:1998
Specifications for pressure-sensitive adhesive tapes for electrical purposes. Specifications for individual materials. PVC film tapes with pressure-sensitive adhesive

BS EN 60454-3-2:2006
Pressure-sensitive adhesive tapes for electrical purposes. Specifications for individual materials. Requirements for polyester film tapes with rubber thermosetting, rubber thermoplastic or acrylic crosslinked adhesives

BS EN 60454-3-4:2007
Pressure-sensitive adhesive tapes for electrical purposes. Specifications for individual materials. Cellulose paper, creped and non-creped, with rubber thermosetting adhesive

BS EN 60454-3-6:1998
Specifications for pressure-sensitive adhesive tapes for electrical purposes. Specifications for individual materials. Polycarbonate film tapes with acrylic thermoplastic adhesive

BS EN 60454-3-7:1998
Specifications for pressure-sensitive adhesive tapes for electrical purposes. Specifications for individual materials. Polyimide film tapes with pressure-sensitive adhesive

BS EN 60454-3-8:2006
Pressure-sensitive adhesive tapes for electrical purposes. Specifications for individual materials. Woven fabric tapes with pressure-sensitive adhesive based on glass, cellulose acetate alone or combined with viscose fibre

BS EN 60454-3-11:2007
Pressure-sensitive adhesive tapes for electrical purposes. Specifications for individual materials. Polyester film combinations with glass filament, creped cellulosic paper, polyester non-woven, epoxy and pressure-sensitive adhesives

BS EN 60454-3-12:2006
Pressure-sensitive adhesive tapes for electrical purposes. Specifications for individual materials. Requirements for polyethylene and polypropylene film tapes with pressure sensitive adhesive

BS EN 60454-3-14:2002
Specifications for pressure-sensitive adhesive tapes for electrical purposes. Specifications for individual materials. Polytetrafluoroethylene film tapes with pressure-sensitive adhesive. Sheet 14: Polytetrafluoroethylene film tapes with pressure-sensitive adhesive.

BS EN 60454-3-19:2003
Specifications for pressure-sensitive adhesive tapes for electrical purposes. Specifications for individual materials. Tapes made from various backing materials with pressure-sensitive adhesive on both sides. Sheet 19: Tapes made from various backing materials with pressure-sensitive adhesive on both sides

BS EN 60529:1992+A2:2013
Degrees of protection provided by enclosures (IP code)

BS EN 60684-1:2003
Flexible insulating sleeving. Part 1 Definitions and general requirements

BS EN 60684-2:2011
Flexible insulating sleeving. Methods of test

BS EN 60684-3-100 TO 105:2002
Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Extruded PVC sleeving. Extruded PVC sleeving

BS EN 60684-3-116:2011
Flexible insulating sleeving. Specifications for individual types of sleeving. Sheets 116 and 117: Extruded polychloroprene, general purpose

BS EN 60684-3-121 TO 124:2001
Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Specifications for individual types of sleeving. Extruded silicone sleeving

BS EN 60684-3-136:1998
Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Extruded fluorosilicone sleeving. General purpose

BS EN 60684-3-145 TO 147:2001
Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Extruded PTFE sleeving

BS EN 60684-3-151:1998
Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Extruded PVC/nitrile rubber. General purpose

BS EN 60684-3-165:2004
Flexible insulating sleeving. Specifications for individual types of sleeving . Extruded Polyolefin, flame retarded, limited fire hazard sleeving

BS EN 60684-3-205:2011
Flexible insulating sleeving. Specifications for individual types of sleeving. Sheet 205: Heat-shrinkable chlorinated polyolefin sleeving, flame retarded, nominal shrink ratio 1,7:1 and 2:1

BS EN 60684-3-209:2010
Flexible insulating sleeving. Specifications for individual types of sleeving. Heat-shrinkable polyolefin sleeving, general purpose, flame retarded

BS EN 60684-3-211:2007
Flexible insulating sleeving. Specifications for individual types of sleeving. Heat-shrinkable sleeving, semi-rigid polyolefin, shrink ratio 2:1

BS EN 60684-3-212:2006
Flexible insulating sleeving. Specifications for individual types of sleeving. Heat-shrinkable polyolefin sleevings

BS EN 60684-3-214:2014
Flexible insulating sleeving. Specifications for individual types of sleeving. Heat-shrinkable, polyolefin sleeving, not flame retarded, thick and medium wall

BS EN 60684-3-216:2005+A2:2014
Flexible insulating sleeving. Specifications for individual types of sleeving. Heat-shrinkable, flame-retarded, limited-fire hazard sleeving

BS EN 60684-3-228:2004
Flexible insulating sleeving. Specification requirements for individual types of sleeving. Heat-shrinkable, semi-rigid polyvinylidene fluoride sleeving, flame retarded, fluid resistant, shrink ratio 2:1

BS EN 60684-3-229:2003

Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Heat-shrinkable semi-flexible, polyvinylidene fluoride sleeving, flame retarded, fluid resistant, shrink ratio 2:1

BS EN 60684-3-233:2006
Flexible insulating sleeving. Specifications for individual types of sleeving. Heat-shrinkable fluoroelastomer sleeving, flame retarded, fluid resistant, shrink ratio 2:1

BS EN 60684-3-240 TO 243:2002
Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Heat-shrinkable PTFE sleeving

BS EN 60684-3-246:2007
Flexible insulating sleeving. Specifications for individual types of sleeving. Heat-shrinkable polyolefin sleeving, dual wall, not flame retarded

BS EN 60684-3-247:2011+A1:2017
Flexible insulating sleeving. Specifications for individual types of sleeving. Sheet 247: Heat- shrinkable polyolefin sleeving, dual wall, not flame retarded, thick and medium wall

BS EN 60684-3-248:2007
Flexible insulating sleeving. Specifications for individual types of sleeving . General purpose, heat-shrinkable, dual wall polyolefin sleeving, flame retarded, shrink ratios 2:1, 3:1, 4:1

BS EN 60684-3-271:2011
Flexible insulating sleeving. Specifications for individual types of sleeving. Heat-shrinkable elastomer sleevings, flame retarded, fluid resistant, shrink ratio 2:1

BS EN 60684-3-280:2010+A1:2014
Flexible insulating sleeving. Specifications for individual types of sleeving. Heat-shrinkable, polyolefin sleeving, anti-tracking

BS EN 60684-3-281:2010
Flexible insulating sleeving. Specifications for individual types of sleeving. Heat-shrinkable, polyolefin sleeving, semiconductive

BS EN 60684-3-282:2010
Flexible insulating sleeving. Specifications for individual types of sleeving. Heat-shrinkable, polyolefin sleeving. Stress control

BS EN 60684-3-283:2011+A1:2014
Flexible insulating sleeving. Specifications for individual types of sleeving. Heat-shrinkable, polyolefin sleeving, for bus-bar insulation

BS EN 60684-3-284:2014
Flexible insulating sleeving. Specifications for individual types of sleeving. Heat-shrinkable, sleevings, for oil barrier applications

BS EN 60684-3-285:2014
Flexible insulating sleeving. Specifications for individual types of sleeving. Sheet 285: Heat-shrinkable polyolefin sleeving, for medium voltage joint insulation

BS EN 60684-3-300:2002
Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Glass textile fibre sleeving, braided, uncoated

BS EN 60684-3-320:2002
Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Polyethylene terephthalate textile sleeving, lightly impregnated

BS EN 60684-3-340 TO 342:2003
Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Expandable braided polyethylene terephthalate textile sleeving

BS EN 60684-3-343 TO 345:2002
Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Expandable braided ethylene chlorotrifluoroethylene (E-CTFE) textile sleeving, uncoated

BS EN 60684-3-400 TO 402:2002
Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Glass textile sleeving with silicone elastomer coating

BS EN 60684-3-403 TO 405:2002
Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Glass textile sleeving with acrylic based coating

BS EN 60684-3-406 TO 408:2003
Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Glass textile sleeving with PVC coating

BS EN 60684-3-409:1999
Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Glass textile sleeving with polyurethane (PUR)-based coating

BS EN 60684-3-420 TO 422:2002
Specification for flexible insulating sleeving. Specification requirements for individual types of sleeving. Polyethylene terephthalate textile sleeving with acrylic based coating

BS EN 60702-1:2002+A1:2015
Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V. Cables

BS EN 60702-2:2002+A1:2015
Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V. Terminations

BS EN 60754-1:2014
Test on gases evolved during combustion of materials from cables. Determination of the halogen acid gas content

BS EN 60754-2:2014
Test on gases evolved during combustion of materials from cables. Determination of acidity (by pH measurement) and conductivity

BS EN 60793-1-1:2017
Optical fibres. Part 1-1 Measurement methods and test procedures. General and guidance

BS EN 60793-1-20:2014
Optical fibres. Measurement methods and test procedures. Fibre geometry

BS EN 60793-1-21:2002
Optical fibres. Measurement methods and test procedures. Coating geometry. Section 21 Coating geometry

BS EN 60793-1-22:2002
Optical fibres. Measurement methods and test procedures. Length measurement. Section 22: Length measurement methods

BS EN 60793-1-30:2011
Optical fibres. Measurement methods and test procedures. Fibre proof test

BS EN 60793-1-31:2010

Optical fibres. Measurement methods and test procedures. Tensile strength

BS EN 60793-1-32:2010
Optical fibres. Measurement methods and test procedures. Coating strippability

BS EN 60793-1-33:2002
Optical fibres. Measurement methods and test procedures. Stress corrosion susceptibility. Section 33 Stress corrosion susceptibility

BS EN 60793-1-34:2006
Optical fibres. Measurement methods and test procedures. Fibre curl

BS EN 60793-1-40:2003
Optical fibres. Measurement methods and test procedures. Attenuation

BS EN 60793-1-41:2010
Optical fibres. Measurement methods and test procedures. Bandwidth

BS EN 60793-1-42:2013
Optical fibres. Measurement methods and test procedures. Chromatic dispersion

BS EN 60793-1-43:2015
Optical fibres. Measurement methods and test procedures. Numerical aperture measurement

BS EN 60793-1-44:2011
Optical fibres. Measurement methods and test procedures. Cut-off wavelength

BS EN 60793-1-45:2003
Optical fibres. Measurement methods and test procedures. Mode field diameter

BS EN 60793-1-46:2002
Optical fibres. Measurement methods and test procedures. Monitoring of changes in optical transmittance

BS EN 60793-1-47:2009
Optical fibres. Measurement methods and test procedures. Macrobending loss

BS EN 60793-1-48:2007
Optical fibres. Part 1-48 Measurement methods and test procedures. Polarization mode dispersion

BS EN 60793-1-49:2006
Optical fibres. Part 1-49 Measurement methods and test procedures. Differential mode delay

BS EN 60793-1-50:2015
Optical fibres. Measurement methods. Damp heat (steady state) tests

BS EN 60793-1-51:2014
Optical fibres. Measurement methods and test procedures. Dry heat (steady state) tests

BS EN 60793-1-52:2014
Optical fibres. Measurement methods and test procedures. Change of temperature tests

BS EN 60793-1-53:2014
Optical fibres. Measurement methods and test procedures. Water immersion tests

BS EN 60793-1-54:2013
Optical fibres. Measurement methods and test procedures. Gamma irradiation

BS EN 60793-2-10:2017
Optical fibres. Part 2-10 Product specification. Sectional specification for category A1 multimode fibres

BS EN 60793-2-10:2017
Optical fibres. Part 2-10 Product specification. Sectional specification for category A1 multimode fibres

BS EN 60793-2-20:2016
Optical fibres. Part 2-20 Product specifications. Sectional specification for category A2 multimode fibres

BS EN 60793-2-30:2015
Optical fibres. Product specifications. Sectional specification for category A3 multimode fibres

BS EN 60793-2-40:2016
Optical fibres. Part 2-40 Product specifications. Sectional specification for category A4 multimode fibres

BS EN 60793-2-60:2008
Optical fibres. Product specifications. Sectional specification for category C single-mode intraconnection fibres

BS EN 60793-2:2016
Optical fibres. Product specifications. General

BS EN 60794-2-10:2016
Optical fibre cables. Part 2-10 Indoor optical fibre cables. Family specification for simplex and duplex cables

BS EN 60794-2-11:2012
Optical fibre cables. Part 2-11 Indoor optical fibre cables. Detailed specification for simplex and duplex cables for use in premises cabling

BS EN 60794-2-20:2014
Optical fibre cables. Indoor cables. Family specification for multi-fibre optical cables

BS EN 60794-2-30:2008
Optical fibre cables. Part 2-30 Indoor cables. Family specification for optical fibre ribbon cables

BS EN 60794-3-10:2015
Optical fibre cables. Outdoor cables. Family specification for duct, directly buried or lashed aerial optical telecommunication cables

BS EN 60794-3-11:2010
Optical fibre cables. Part 3-11 Outdoor cables. Product specification for duct, directly buried and lashed aerial single-mode optical fibre telecommunication cables

BS EN 60794-3-20:2016
Optical fibre cables. Part 3-20 Outdoor cables. Family specification for optical self-supporting aerial telecommunication cables

BS EN 60794-3-30:2008
Optical fibres. Outdoor cables. Family specification for optical telecommunication cables for lakes, river crossings and coastal application

BS EN 60794-3:2015
Optical fibre cables. Part 3 Sectional specification. Outdoor cables

BS EN 60794-4:2003
Optical fibre cables. Sectional specification. Part 4 Aerial optical cables along electrical power lines

BS EN 60811-100:2012
Electrical and optical fibre cables. Test methods for non-metallic materials. Part 101 General

BS EN 60811-201:2012
Electric and optical fibre cables. Test methods for non-metallic materials. General tests. Measurement of insulation thickness

BS EN 60811-202:2012
Electric and optical fibre cables. Test methods for non-metallic materials. General tests. Measurement of thickness of non-metallic sheath

BS EN 60811-203:2012
Electric and optical fibre cables. Test methods for non-metallic materials. General tests. Measurement of overall dimensions

BS EN 60811-301:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Electrical tests. Measurement of the permittivity at 23°C of filling compounds

BS EN 60811-302:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Electrical tests. Measurement of the d.c. resistivity at 23°C and 100°C of filling compounds

BS EN 60811-401:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Miscellaneous tests. Thermal ageing methods. Ageing in an air oven

BS EN 60811-402:2012
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BS EN 60811-403:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Miscellaneous tests. Ozone resistance test on cross-linked compounds

BS EN 60811-404:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Miscellaneous tests. Mineral oil immersion tests for sheaths

BS EN 60811-405:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Miscellaneous tests. Thermal stability test for PVC insulations and PVC sheaths

BS EN 60811-406:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Miscellaneous tests. Resistance to stress cracking of polyethylene and polypropylene compounds

BS EN 60811-407:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Miscellaneous tests. Measurement of mass increase of polyethylene and polypropylene compounds

BS EN 60811-408:2012
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BS EN 60811-409:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Miscellaneous tests. Loss of mass test for thermoplastic insulations and sheaths

BS EN 60811-410:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Miscellaneous tests. Test

method for copper-catalyzed oxidative degradation of polyolefin insulated conductors

BS EN 60811-411:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Miscellaneous tests. Low-temperature brittleness of filling compounds

BS EN 60811-412:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Miscellaneous tests. Thermal ageing methods. Ageing in an air bomb

BS EN 60811-501:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Mechanical tests. Tests for determining the mechanical properties of insulating and sheathing compounds

BS EN 60811-502:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Mechanical tests. Shrinkage test for insulations

BS EN 60811-503:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Mechanical tests. Shrinkage test for sheaths

BS EN 60811-504:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Mechanical tests. Bending tests at low temperature for insulation and sheaths

BS EN 60811-505:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Mechanical tests. Elongation at low temperature for insulations and sheaths

BS EN 60811-506:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Mechanical tests. Impact test at low temperature for insulations and sheaths

BS EN 60811-507:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Mechanical tests. Hot set test for cross-linked materials

BS EN 60811-508:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Mechanical tests. Pressure test at high temperature for insulation and sheaths

BS EN 60811-509:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Mechanical tests. Test for resistance of insulations and sheaths to cracking (heat shock test)

BS EN 60811-510:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Mechanical tests. Methods specific to polyethylene and polypropylene compounds. Wrapping test after thermal ageing in air

BS EN 60811-511:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Mechanical tests. Measurement of the melt flow index of polyethylene compounds

BS EN 60811-512:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Mechanical tests. Methods specific to polyethylene and polypropylene compounds. Tensile strength and elongation at break after conditioning at elevated temperature

BS EN 60811-513:2012

Electric and optical fibre cables. Test methods for non-metallic materials. Mechanical tests. Methods specific to polyethylene and polypropylene compounds. Wrapping test after conditioning

BS EN 60811-601:2012
Electric and optical fibre cables. Test methods for non-metallic materials . Physical tests. Measurement of the drop point of filling compounds

BS EN 60811-602:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Physical tests. Separation of oil in filling compounds

BS EN 60811-603:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Physical tests. Measurement of total acid number of filling compounds

BS EN 60811-604:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Physical tests. Measurement of absence of corrosive components in filling compounds

BS EN 60811-605:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Physical tests. Measurement of carbon black and/or mineral filler in polyethylene compounds

BS EN 60811-606:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Physical tests. Methods for determining the density

BS EN 60811-607:2012
Electric and optical fibre cables. Test methods for non-metallic materials. Physical tests. Test for the assessment of carbon black dispersion in polyethylene and polypropylene

BS EN 60874-1-1:2012
Fibre optic interconnecting devices and passive components. Connectors for optical fibres and cables. Blank detail specification

BS EN 60874-1:2012
Fibre optic interconnecting devices and passive components. Connectors for optical fibres and cables. Generic specification

BS EN 60874-17:1997
Connectors for optical fibres and cables. Sectional specification for fibre optic connector. Type F-05 (friction lock)

BS EN 60874-19:1997
Connectors for optical fibres and cables. Sectional specification for fibre optic connector. Type SC-D (Duplex)

BS EN 61034-2:2005+A1:2013
Measurement of smoke density of cables burning under defined conditions. Part 2 Test procedure and requirements

BS EN 61073-1:2009
Fibre optic interconnecting devices and Passive components. Mechanical splices and fusion splice protectors for optical fibres and cables. Generic specification

BS EN 61196-4:2004
Coaxial communication cables. Part 4 Sectional specification for radiating cables

BS EN 61300-1:2016
Fibre optic interconnecting devices and passive components. Basic test and measurement

procedures. General and guidance

BS EN 61300-2-1:2009
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Vibration (sinusoidal)

BS EN 61300-2-2:2008
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Mating durability

BS EN 61300-2-4:1997
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Fibre/cable retention

BS EN 61300-2-5:2011
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Torsion

BS EN 61300-2-6:2011
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Tensile strength of coupling mechanism

BS EN 61300-2-7:2013
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Bending moment

BS EN 61300-2-8:1997
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BS EN 61300-2-9:2017
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Shock

BS EN 61300-2-10:2012
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Crush resistance

BS EN 61300-2-11:2013
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Axial compression

BS EN 61300-2-12:2009
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Impact

BS EN 61300-2-13:1997
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Acceleration

BS EN 61300-2-14:2013
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. High optical power

BS EN 61300-2-15:2008
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Torque strength of coupling mechanism

BS EN 61300-2-17:2011
Fibre optic interconnecting devices and passive components. Basic test and measurement

procedures. Tests. Cold

BS EN 61300-2-18:2005
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Dry heat. High temperature endurance

BS EN 61300-2-19:2013
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Damp heat (steady state)

BS EN 61300-2-21:2010
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Composite temperature/humidity cyclic test

BS EN 61300-2-22:2007
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Change of temperature

BS EN 61300-2-23:2011
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Sealing for non-pressurized closures of fibre optic devices

BS EN 61300-2-24:2010
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Screen testing of ceramic alignment split sleeve by stress application

BS EN 61300-2-26:2007
Fibre optic interconnecting devices and passive Components. Basic test and measurement procedures. Tests. Salt mist

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Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Dust. Laminar flow

BS EN 61300-2-28:2013
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Industrial atmosphere (sulphur dioxide)

BS EN 61300-2-29:1997
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Tests. Low air pressure

BS EN 61300-2-30:1997
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Solar radiation

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Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Water vapour permeation

BS EN 61300-2-33:2012
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Assembly and disassembly of fibre optic mechanical splices, fibre management systems and closures

BS EN 61300-2-34:2009
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Resistance to solvents and contaminating fluids of interconnecting components and closures

BS EN 61300-2-35:2014
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Cable nutation

BS EN 61300-2-36:1997
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Flammability (fire hazard)

BS EN 61300-2-37:2016
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Cable bending for fibre optic closures

BS EN 61300-2-38:2006
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Sealing for pressurized fibre optic closures

BS EN 61300-2-39:1997
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Susceptibility to external magnetic fields

BS EN 61300-2-40:2001
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BS EN 61300-2-42:2014
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Static side load for strain relief

BS EN 61300-2-43:2014
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Screen testing of return loss of single-mode PC optical fibre connectors

BS EN 61300-2-44:2013
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Flexing of the strain relief of fibre optic devices

BS EN 61300-2-45:1999
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Durability test by water immersion

BS EN 61300-2-46:2006
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Damp heat cyclic

BS EN 61300-2-47:2016
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BS EN 61300-2-48:2009
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Temperature-humidity cycling

BS EN 61300-2-49:2007

Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Connector installation test

BS EN 61300-2-50:2007
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Fibre optic connector proof test with static load. Singlemode and multimode

BS EN 61300-2-51:2007
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Fibre optic connector test for transmission with applied tensile load. Singlemode and multimode

BS EN 61300-2-52:2013
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Bending test for cords

BS EN 61300-2-55:2017
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Tests. Strength of mounted adaptor

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Fire optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Visual examination

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Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Polarization dependent loss in a single-mode fibre optic device

BS EN 61300-3-3:2009
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Active monitoring of changes in attenuation and return loss

BS EN 61300-3-4:2013
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Attenuation

BS EN 61300-3-6:2009
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Return loss

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Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Wavelength dependence of attenuation and return loss of single mode components

BS EN 61300-3-8:1997
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Ambient light susceptibility

BS EN 61300-3-9:1997
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Far-end crosstalk

BS EN 61300-3-10:2007
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Gauge retention force

BS EN 61300-3-11:1997
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Engagement and separation forces

BS EN 61300-3-13:1997
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Control stability of a fibre optic switch

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Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Error and repeatability of the attenuation settings of a variable optical attenuator

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Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Switching time

BS EN 61300-3-22:2011
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Ferrule compression force

BS EN 61300-3-24:2007
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Keying accuracy of optical connectors for polarization maintaining fibre

BS EN 61300-3-25:2016
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BS EN 61300-3-27:1997
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Measurement method for the hole location of a multiway connector plug. Section 27: Measurement method for the hole location of a multiway connector plug.

BS EN 61300-3-28:2012
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BS EN 61300-3-29:2014

Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Spectral transfer characteristics of DWDM devices

BS EN 61300-3-30:2003
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Polish angle and fibre position on single ferrule multifibre connectors

BS EN 61300-3-31:2003
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BS EN 61300-3-32:2006
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Polarization mode dispersion measurement for passive optical components

BS EN 61300-3-33:2012
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Withdrawal force from a resilient alignment sleeve using gauge pins

BS EN 61300-3-34:2009
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Attenuation of random mated connectors

BS EN 61300-3-35:2015
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Visual inspection of fibre optic connectors and fibre-stub transceivers

BS EN 61300-3-36:2000
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Examinations and measurements. Measurement methods for the inside and outside diameters of fibre optic connector ferrules

BS EN 61300-3-37:2005
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Endface angle of angle- polished optical fibres

BS EN 61300-3-38:2012
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Group delay, chromatic dispersion and phase ripple

BS EN 61300-3-39:2012
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Physical contact (PC) optical connector reference plug selection for return loss measurements

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Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Mode transfer function measurement for fibre optic sources

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Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Attenuation of random mated multi-fibre connectors

BS EN 61300-3-46:2011
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Measurement. Bore diameter for guide pin in MT ferrules

BS EN 61300-3-47:2014
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. End face geometry of PC/APC spherically polished ferrules using interferometry

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Fibre optic interconnect devices and passive components. Basic test and measurement procedures. Examinations and measurements. Spring compression force of the coupling sleeve for rectangular ferrule multi-fibre connectors

BS EN 61300-3-49:2013
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Guide pin retention force for rectangular ferrule multi-fibre connectors

BS EN 61300-3-50:2013
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Crosstalk for optical spatial switches

BS EN 61300-3-51:2014
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Pin gauge withdrawal force for rectangular ferrule multi-fibre connectors

BS EN 61300-3-52:2014
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Guide hole and alignment pin deformation constant, CD for 8 degree angled PC rectangular ferrule, single mode fibres

BS EN 61300-3-53:2015
Fibre optic interconnecting devices and passive components. Basic test and measurement procedures. Examinations and measurements. Encircled angular flux (EAF) measurement method based on two-dimensional far field data from step index multimode waveguide (including fibre)

BS EN 61439-1:2011
Low-voltage switchgear and controlgear assemblies. Part 1 General rules

BS EN 61439-2:2011
Low-voltage switchgear and controlgear assemblies. Power switchgear and controlgear assemblies

BS EN 61439-3:2012
Low-voltage switchgear and controlgear assemblies. Distribution boards intended to be operated by ordinary persons (DBO)

BS EN 61439-4:2013
Low-voltage switchgear and controlgear assemblies. Particular requirements for assemblies for construction sites (ACS)

BS EN 61439-5:2015
Low-voltage switchgear and controlgear assemblies. Assemblies for power distribution in public networks

BS EN 61439-6:2012
Low-voltage switchgear and controlgear assemblies. Busbar trunking systems (busways)

BS EN 61535:2009+A1:2013
Installation couplers intended for permanent connection in fixed installations

BS EN 61754-1:2013
Fibre optic interconnecting devices and passive components. Fibre optic connector interfaces. General and guidance

BS EN 61754-2:1997
Fibre optic connector interfaces. Part 2 Type BFOC/2,5 connector family

BS EN 61754-3:2002
Fibre optic connector interfaces. Part 3 Type LSA connector family

BS EN 61754-4-1:2003
Fibre optic connector interfaces. Type SC connector family. Simplified receptacle SC-PC connector interfaces

BS EN 61754-4:2013
Fibre optic interconnecting devices and passive components. Fibre optic connector interfaces. Type SC connector family

BS EN 61754-5:2005
Fibre optic connector interfaces. Type MT connector family

BS EN 61754-6-1:2003
Fibre optic connector interfaces. Type MU connector family. Simplified receptacle MU-PC connector interfaces

BS EN 61754-6:2013
Fibre optic interconnecting devices and passive components. Fibre optic connector interfaces. Type MU connector family

BS EN 61754-7-1:2014
Fibre optic interconnecting devices and passive components. Fibre optic connector interfaces. Type MPO connector family. One fibre row

BS EN 61754-7:2008
Fibre optic interconnecting devices and passive components. Fibre optic connector interfaces. Type MPO connector family

BS EN 61754-8:1997
Fibre optic connector interfaces. Part 8 Type CF08 connector family

BS EN 61754-9:2001
Fibre optic connector interfaces. Part 9 Type DS connector family

BS EN 61754-10:2005
Fibre optic connector interfaces. Part 10 Type Mini-MPO connector family

BS EN 61754-12:2000
Fibre optic connector interfaces. Part 12 Type FS connector family

BS EN 61754-13:2006
Fibre optic connector interfaces. Type FC-PC connector

BS EN 61754-15:2009
Fibre optic connector interfaces. Part 15 Type LSH connector family

BS EN 61754-16:2000
Fibre optic connector interfaces. Part 16 Type PN connector family

BS EN 61754-18:2002
Fibre optic connector interfaces. Type MT-RJ connector family

BS EN 61754-19:2002
Fibre optic connector interfaces. Part 19 Type SG connector family

BS EN 61754-20-100:2012
Fibre optic interconnecting devices and passive components. Fibre optic connector interfaces. Interface standard for LC connectors with protective housings related to IEC 61076-3-106

BS EN 61754-20:2012
Fibre optic interconnecting devices and passive components. Fibre optic connector interfaces. Type LC connector family

BS EN 61754-21:2005
Fibre optic connector interfaces. Type SMI connector family for plastic optical fibre

BS EN 61754-22:2005
Fibre optic connector interfaces. Type F-SMA connector family

BS EN 61754-23:2005
Fibre optic connector interfaces. Type LX.5 connector family

BS EN 61754-24-11:2009
Fibre optic interconnecting devices and passive components. Fibre optic connector interfaces. Type SC-RJ connectors with protective housings based on IEC 61076-3-117

BS EN 61754-24-21:2009
Fibre optic interconnecting devices and passive components. Fibre optic connector interfaces. Type SC-RJ connectors with protective housings based on IEC 61076-3-106, variant 06

BS EN 61754-24:2010
Fibre optic interconnecting devices and passive components. Fibre optic connector interfaces. Type SC-RJ connector family

BS EN 61754-25:2009
Fibre optic connector interfaces. Type RAO connector family

BS EN 61754-26:2012
Fibre optic interconnecting devices and passive components. Fibre optic connector interfaces. Type SF connector family

BS EN 61754-27:2013
Fibre optic interconnecting devices and passive components. Fibre optic connector interfaces. Type M12-FO connector family

BS EN 61754-28:2012
Fibre optic interconnecting devices and passive components. Fibre optic connector interfaces. Type LF3 connector family

BS EN 61754-29:2012

Fibre optic interconnecting devices and passive components. Fibre optic connector interfaces. Type BLINK connector series

BS EN 61754-30:2014
Fibre optic interconnecting devices and passive components. Fibre optic connector interfaces. Type CLIK connector series

BS EN 61984:2009
Connectors. Safety requirements and tests

BS EN 62148-2:2011
Fibre optic active components and devices. Package and interface standards. SFF 10-pin transceivers

BS EN 62148-3:2011
Fibre optic active components and devices. Package and interface standards. SFF 20-pin transceivers

BS EN 62148-4:2003
Fibre optic active components and devices. Package and interface standards. PN 1x9 plastic optical fibre transceivers

BS EN 62148-5:2003
Fibre optic active components and devices. Package and interface standards. SC 1x9 fibre optic modules

BS EN 62148-6:2003
Fibre optic active components and devices. Package and interface standards. ATM-PON transceivers

BS EN 62148-11:2009
Fibre optic active components and devices. Package and interface standards. 14-pin active device modules

BS EN 62148-12:2004
Fibre optic active components and devices. Package and interface standards. Laser transmitters with coaxial RF connector

BS EN 62148-15:2014
Fibre optic active components and devices. Package and interface standards. Discrete vertical cavity surface emitting laser packages

BS EN 62148-16:2009
Fibre optic active components and devices. Package and interface standards. Transmitter and receiver components for use with LC connector interface

BS EN 62148-17:2014
Fibre optic active components and devices. Package and interface standards. Transmitter and receiver components with dual coaxial RF connectors

BS EN 62148-18:2015
Fibre optic active components and devices. Package and interface standards. 40-Gbit/s serial transmitter and receiver components for use with the LC connector interface

BS EN 62444:2013
Cable glands for electrical installations.

BS EN 62664-1-1:2013
Fibre optic interconnecting devices and passive components. Fibre optic connector product specifications. LC-PC duplex multimode connectors terminated on IEC 60793-2-10 category A1a fibre

BS EN 186110:1995
Harmonized system of quality assessment for electronic components. Sectional specification:

connector sets for optical fibres and cables. Type FC

BS EN 186130:1996
Harmonized system of quality assessment for electronic components. Sectional specification. Connector sets for optical fibres and cables. Type LSA

BS EN 186150:1997
Connector sets for optical fibres and cables. Type OCCA-BU

BS EN 186160:1997
Connector sets for optical fibres and cables. Type OCCA-PC

BS EN 186180:1996
Harmonized system of quality assessment for electronic components. Sectional specification. Connector sets for optical fibres and cables. Type LSB

BS EN 186220:1996
Harmonized system of quality assessment for electronic components. Sectional specification: Connector sets for optical fibres and cables. Type LSC

BS EN 186230:1996
Harmonized system of quality assessment for electronic components. Sectional specification: connector sets for optical fibres and cables. Type LSF

BS EN 186260:1998
Harmonized system of quality assessment for electronic components. Sectional specification: connector sets for optical fibres and cables. Type SC

BS EN 186270:1998
Harmonized system of quality assessment for electronic components. Sectional specification: connector sets for optical fibres and cables. Type LSH

BS EN 187103:2003
Harmonized system of quality assessment for electronic components. Family specification. Optical fibre cables for indoor applications

BS EN ISO 7010:2012+A7:2017
Graphical symbols. Safety colours and safety signs. Registered safety signs

BS IEC 60874-14-1:1997
Connectors for optical fibres and cables. Part 14-1 Detail specification for fibre optic connector type SC-PC standard terminated to multimode fibre type A1 a, A1b

BS IEC 60874-14-3:1997
Detail specification for fibre optic adaptor (simplex) type SC for single-mode fibre

BS IEC 60874-14-4:1997
Detail specification for fibre optic adaptor (simplex) type SC for multimode fibre

BS IEC 60874-14-5:1997
Connectors for optical fibres and cables. Detail specification for fibre optic connector type SC-PC untuned terminated to single-mode fibre type B1

Y72 CONTACTORS AND STARTERS

1010A 3-PHASE SUPPLY:
- Ensure all electrical equipment supplied and installed is suitable for 3-phase power supply to BS EN 60038.

1010B SINGLE-PHASE ELECTRICAL SUPPLY:
- Ensure all electrical equipment supplied and installed is suitable for single-phase power supply to BS EN 60038.

1010C 3-PHASE AND NEUTRAL SUPPLY:
- Ensure all electrical equipment supplied and installed is suitable for 3-phase and neutral power supply to BS EN 60038

1020A MANUFACTURER FITTED SURGE SUPPRESSORS:
- Supply surge suppressors to star connected motors and to all motors subject to star-delta starting to limit peak voltage to 1200 volts. Fitted by Manufacturer.

1020B INSTALLER FITTED SURGE SUPPRESSORS:
- Supply surge suppressors to star connected motors and to all motors subject to star-delta starting to limit peak voltage to 1200 volts. Fitted by installer.

1030A MANUFACTURER FITTED TRANSIENT SUPPRESSORS:
- Supply transient suppressors in the form of resistor and capacitor networks across the starter contactor coils. Fitted by Manufacturer.

1030B INSTALLER FITTED TRANSIENT SUPPRESSORS:
- Supply transient suppressors in the form of resistor and capacitor networks across the starter contactor coils. Fitted by installer.

2010A CONTROLGEAR ASSEMBLY:
- Standard
  - BS EN 61439-1.
  - BS EN 61439-2.
- External design - Cubicle type assembly.
- Usage - Control panel, Motor Control Centre (MCC) or single starter enclosure.
- Conditions of installation - Indoors.
- Electrical characteristics
  - Rated operational voltage, 400 V. Rated short-time withstand current, 20 times rated current.
- Service conditions - Ambient air temperature and altitude to relevant parts of BS EN 61439.
- Co-ordination in accordance with BS 7671 (IET Wiring Regulations)
  - Ensure that the relevant fault current (short-circuit) rating of each switchgear and controlgear assembly is greater than or equal to the maximum prospective fault current at the point of connection to the system.
  - Ensure that the relevant design current does not exceed the rated current of the assembly, or rated current of a circuit of the associated assembly, taking into account applicable diversity and loading factors.
  - Ensure that any devices and components are integrated into the assembly in accordance with the relevant parts of BS EN 61439.

2020A ASSEMBLY CONSTRUCTION:
- Enclosure standard - BS EN 62208.
- Material of enclosure - Manufacturer's standard.
- Terminals for external conductors, main power circuits
  - Accommodate cross-sectional area of copper cables in accordance with relevant parts of BS EN 61439.
- Terminals for external conductor, control and auxiliary circuits
  - Terminal block. Mounting - top hat rails dimensional type TH 35-7,5 to BS EN 60715. Steel rails to be manufactured and finished in accordance with Appendix A to BS EN 60715.

- Size of neutrals on 3-phase supplies
- Full current-carrying capacity of phase conductor.
- Degree of protection to BS EN 60529
  - IP31 for units installed inside buildings excluding boiler rooms and pump rooms.
  - IP55 for units installed in boiler rooms, pump rooms and outside buildings.
- Protection against direct and indirect contact as Manufacturer's standard.
- Accessibility for inspection
  - Arrange for following operations to be performed when assembly is in service and under voltage.
  - Visual inspection of switching devices and other apparatus; settings and indicators of relays and releases; conductor connections and markings.
  - Adjusting and re-setting of relays, releases and electronic devices.
  - Replacement of fusel inks and indicating lamps.
  - Fault location by voltage and current measuring.
- Accessibility for maintenance
  - Provide space between functional unit or group and adjacent functional units or groups. Provide retainable fastening means for parts likely to be removed for maintenance.
  - Use barrier protected sub-sections for each functional unit or group.
  - Use compartments for each functional unit or group.
- Removable parts and withdrawable parts
  - Degree of protection of assembly after removal or withdrawal of part as manufacturer's standard.
- Internal separation - Manufacturer's standard.
- Input voltage variations for electronic equipment supply - relevant parts of BS EN 61439.
- Supply frequency deviation - relevant parts of BS EN 61439.
- Mounting - Floor standing or wall-mounted.

2030A ENCLOSURE FINISH:

- Apply high standard finish to enclosure and supporting metalwork. Degrease metal and remove rust prior to applying finish.
- Comply with paint manufacturer's recommendations regarding preparation, stoving times, temperatures, mixing of finishes, application and coat thickness.
- Finish - Manufacturer's standard.
- Colour - Manufacturer's standard colour.

2040 SITE MODIFICATION:

- Do not make site alterations unless authorised. Where site modifications to assemblies are authorised make in accordance with manufacturer's certified drawings and instructions. Ensure that modifications made comply with type test certificate obtained for arrangement of components.

2050C CONTINUOUS LV CONTACTORS AND MOTOR STARTERS:

- Standard
  - BS EN 60947-4-1
  - BS EN 60947-4-2
  - BS EN 60947-4-3
  - BS EN 62626-1
- Type of equipment - AC mechanical contactor. Interrupting medium, air.
  - Operating condition.
    - Method of operation - Electromagnetic.
    - Method of control - Automatic.
- Rated and limiting values for the main circuit.
  - Rated voltage (Volts) - Operational, 400.
  - Rated duty - Continuous.
  - Operational performance.
    - One rotation direction, with motor stopping between operations.
  - Control circuits
    - Electrical - AC; rated frequency (Hertz), 50; rated voltage (Volts), 230.
  - Co-ordination with short-circuit protective devices - Type1
  - Enclosure degree of protection to BS EN 60529, IP31, or IP65 where BS EN 62626-1 applies.
  - Minimum mechanical and electrical endurance

    - Mechanical 0.3 million; electrical 15,000.
  - Provide mechanical and electrical interlocks to prevent simultaneous closure of paired contactors.

2060A CONTROL CIRCUIT DEVICES:
- Standard
  - BS EN 60947-5-1
- Type of equipment.
  - AC control circuit device
  - Manual control switches; emergency stop; control relays; pilot switches; position switches; associated equipment; auxiliary contacts and indicating lamps.
  - Interrupting medium, Air.
  - Operating condition.
    - Method of operation - electromagnetic.
    - Method of control - automatic.
- Rated and limiting values for the main circuit.
  - Rated voltage (Volts) - operational, 230.
  - Rated frequency (Hertz), 50.
  - Contact element classification.
  - Enclosure degree of protection IP31.

2070A ISOLATING SWITCHES:
- Standard
  - BS EN 60947-3.
  - BS EN 62626-1
- Provide independent manual operation type isolating switches with rated duty, rated operational current and utilization category compatible with contactor.

2080A CONTROL SELECTOR SWITCHES:
- Standard
  - BS EN 60947-5-1
  - BS EN 62626-1
- Provide panel mounting independent manual operation rotary type switch to select local/off/remote control.
- Ensure switch rated thermal current, rated operational current, and utilization category are compatible with contactor control circuit characteristics and circuit protection device.

2090A IN-BUILT PUSH BUTTONS:
- Provide panel mounting type push buttons with actuator colours to BS EN 60073.
- Standard
  - BS EN 60947-5-1.
- Pattern
  - Supply flush button type start/on and reset push buttons. Supply mushroom actuator type stop/off push buttons released by turning the actuator.
- Ensure rated thermal current, rated operational current and utilization category of push button contacts are compatible with contactor control circuit characteristics and circuit protection device.

2100A INDICATOR LIGHTS:
- Supply lamps of same type throughout. Provide indicator lamps with lamp test facility.
- Standard
  - BS EN 842
  - BS EN 60947-5-1.
- Details
  - Supply interchangeable indicators for respective units. Provide neon indicators. Provide 230V indicator circuits and lamps.
- Protect wiring to indicator lamp units by separate cartridge fuses.
- Lens colour - In accordance with BS EN 60073.

2110A CONTACTOR CONTROL RELAYS:
- Standard BS EN 60947-5-1, install relays in contactor enclosure.
- Relay enclosure protection to BS EN 60529
  - Compatible with contactor enclosure.

2120A CONTROL AND INDICATOR LIGHT CIRCUIT FUSES:
- Provide in contactor enclosure separate low voltage fuse bases, fuse carriers and cartridge fuses for protection of control circuits and indicator light circuits.
- Fuses
  - Fully shrouded impact resistant moulded plastic fuse bases and carriers in accordance with BS 88 (BS EN 60269).

2130A MOTOR STARTERS - MOTORS BELOW 0.37 KW:
- Provide fuses or circuit breakers for motors below 0.37 kW.
- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1

2130B MOTOR STARTERS - MOTORS OF 0.37KW AND ABOVE:
- Provide starters incorporating overcurrent protection for motors of 0.37kW and above.
  - Provide starter with manual reset, adjustable, inverse time delay, and ambient temperature compensated thermal overcurrent release to BS EN 60947-4-1. Ensure overcurrent release is compatible with starting, accelerating and running characteristics of motor, starter and driven machine combination. Use phase unbalance protection on 3-phase equipment.
- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1

2150 DIRECT-ON-LINE MOTOR STARTERS:
- Use direct-on-line starter to BS EN 60947-4-1, with single-phase motors and 3-phase motors.
- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1

2160 STAR DELTA MOTOR STARTERS:
- Use star delta starter to BS EN 60947-4-1 with 3-phase motors.
- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1
- Incorporate adjustable time delay contactor relays, to control star delta changeover, ensuring electrical endurance compatible with starter contactors. Ensure starting sequence activated on voltage restoration.

2190A VARIABLE SPEED MOTOR DRIVES - LOCATED IN LOCAL CONTROL PANEL OR EXPOSED WALL OR FRAME MOUNTED:
- Supply VSD's tailor made for HVAC application with two built in PID controllers, built in HVAC application macros and real-time clock and calendar to control speed of standard AC squirrel cage motors.
- VSD type - digital Pulse Width Modulation PWM.
- Location - control panel.
- Control range - 0.5 to 120 Hz.
- Power factor - 0.97 lagging or better.
- Starting current - not to exceed 1 x FLC.
- Provide integrated, lockable incoming mains isolation switch.
- Characteristics
  - Ensure acceleration and deceleration ramps are independently adjustable
  - Allow connection to a turning motor without braking to a standstill
  - Allow connection to a reverse windmilling fan without causing tripping and return fan to correct speed. Ensure VSD's require no additional means for starting. Supply VSD's that do not require electrical matching to motor. Ensure VSD's are capable of running motors in parallel
  - EMC characteristics to BS EN IEC 61800-3, Category C2
- Standards
  - Comply with relevant parts of BS EN 60204 for safety of electrical equipment
  - Comply with relevant parts of BS EN IEC 61800
  - Comply with relevant parts of BS EN 60068 for environmental testing
- Harmonics

- Comply with BS EN 61000-3-12
- Incorporate facilities into the drive to minimise harmonics generated at partial loads to ENA Engineering recommendation G5/4-1 limits

- Mains interruption
  - Ensure VSD does not cause tripping through a mains interruption of 200 msec.
- Protection
  - Ensure VSD incorporates the following protection to cause electronic shut down without operating circuit protective devices
  - Motor phase to phase fault; motor phase to earth fault; overvoltage; undervoltage; inverter overheat; motor overheat; loss of control signal; loss of auxiliary control voltage; current limit
- VSD controls - local/remote facility to be provided where appropriate for operational and maintenance use.
- Display
  - Make provision for inverter to display externally, external and internal faults following a failure.
  - Show 1st, 2nd and 3rd up sequential faults
  - Provide digital readout to show output frequency Hz; reference 1 (Hand); reference 2 (Auto); motor current (% or Amps); fault memory
  - Provide volt free remote signalling contacts to indicate common fault; running/stopped conditions; healthy/tripped conditions
  - Ensure parameters can be set and fault memory interrogated with door closed, and without additional instrumentation
- Mounting
  - Wall mount vertically in accordance with the manufacturer's recommendations or mount within a control panel cabinet in accordance with the manufacturer's recommendations.
- Cooling
  - Ensure the free space around the drive is in accordance with the manufacturer's recommendations for ventilation and maintenance.
  - When installing a VSD in a control panel cabinet, provide ventilation openings and if required cooling fans in the cabinet to ensure air cannot be recirculated such that the cooling air does not exceed the unit ambient maximum operating temperature.
- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1

2190B VARIABLE SPEED MOTOR DRIVES (LOCATED IN MOTOR CONTROL CENTRES) :

- Supply frequency converters (inverters) tailor made for HVAC application with two built in PID controllers, built in HVAC application macros and real-time clock and calendar to control speed of standard AC squirrel cage motors.
- Inverter type - digital Pulse Width Modulation PWM.
- Location - Motor Control Centre (MCC).
- Control range - 0.5 to 120 Hz power factor - 0.97 lagging or better.
- Starting current - not to exceed 1 x FLC.
- Provide integrated, lockable incoming mains isolation switch.
- Characteristics
  - Ensure acceleration and deceleration ramps are independently adjustable
  - Allow connection to a turning motor without braking to a standstill
  - Allow connection to a reverse windmilling fan without causing tripping and return fan to correct speed. Ensure VSD's require no additional means for starting. Supply VSD's that do not require electrical matching to motor. Ensure VSD's are capable of running motors in parallel
  - EMC characteristics to BS EN IEC 61800-3, Category C2
- Standards
  - Comply with relevant parts of BS EN 60204 for safety of electrical equipment
  - Comply with relevant parts of BS EN IEC 61800 and BS EN 61800
  - Comply with relevant parts of BS EN 60068 for environmental testing
- Harmonics
  - Comply with BS EN 61000-3-12
  - Incorporate facilities into the drive to minimise harmonics generated at partial loads to ENA Engineering recommendation G5/4-1 limits
- Mains interruption
  - Ensure VSD does not cause tripping through a mains interruption of 200 msec.

- Protection
  - Ensure VSD incorporates the following protection to cause electronic shut down without operating circuit protective devices
  - Motor phase to phase fault; motor phase to earth fault; overvoltage; undervoltage; VSD overheat; motor overheat; loss of control signal; loss of auxiliary control voltage; current limit
- VSD controls - local/remote facility to be provided where appropriate for operational and maintenance use.
- Display
  - Make provision for inverter to display externally, external and internal faults following a failure.
  - Show 1st, 2nd and 3rd up sequential faults
  - Provide digital readout to show output frequency Hz; reference 1 (hand); reference 2 (auto); motor current (% or Amps); fault memory
  - Provide volt free remote signalling contacts to indicate common fault; running/stopped conditions; healthy/tripped conditions
  - Ensure parameters can be set and fault memory interrogated with door closed, and without additional instrumentation
- Mounting
  - Flange mount vertically within the MCC in accordance with the manufacturer's recommendations.
- Cooling
  - Ensure the free space around the drive is in accordance with the manufacturer's recommendations for ventilation and maintenance
  - When installing a VSD in a cabinet to ensure air cannot be recirculated such that the cooling air does not exceed the unit ambient maximum operating temperature
- Provide isolation during repair and maintenance work in accordance with BS EN 62626-1

2200 AUTOMATIC CHANGEOVER FOR RUN/STANDBY DUTY - SINGLE POWER SUPPLY:
- Fit a control switch to starter enclosure arranged to select either motor for "run" or "standby" duty. Indicate selection of respective motor by illumination of indicator lights on starter enclosure.
- Provide facilities for connection of remote indicator lights to indicate selection/operation of system and for connection of a system malfunction audible alarm where indicated.
- Arrange for selected "run" duty motor to operate in response to system controls, and in event of operation of duty motor starter overcurrent trip, for automatic changeover to "standby" motor.
- Control power supply to starter by an air break isolating switch interlocked with starter enclosure access door.

2210 AUTOMATIC CHANGEOVER FOR RUN/STANDBY DUTY - DUAL POWER SUPPLY:
- Fit a control switch to starter enclosure arranged to select either motor for "run" or "standby" duty.
- Indicate selection of respective motor and availability of the two power supplies by illumination of indicator lights on starter enclosure.
- Provide facilities for connection of remote indicator lights to indicate selection/operation of system and for connection of a system malfunction audible alarm where indicated.
- Arrange for selected "run" duty motor to operate in response to system controls, and on loss of power supply to "run" duty motor or operation of motor starter overcurrent trip, for automatic changeover to "standby" motor.
- Control the two power supplies by a single air break multiple isolating switch interlocked with starter enclosure access door.

2220 CONTROL CIRCUIT POWER SUPPLIES / TRANSFORMERS:
- Provide control circuit transformers to supply power at voltages to suit control components.
- Standard
  - Use transformers in accordance with BS EN 61558-1 and BS EN 61558-2-2 and provide an external label of approved type and size.
- Protection - primary and secondary fuses.

2230A SWITCHING AND INDICATION:
- Provide switches, indicating lamps, instruments and controls of uniform appearance and physically protected.
- Switches and indicators

- Fit on panel or access doors Stop/Start/Reset push buttons; Auto/Off/Manual control selector switch; run and trip indicator lights.

2240 AUDIBLE ALARMS:
- Ensure that operation of any starter trip lamp, safety circuit lamp or alarm lamp operates a common audible alarm with mute and test facilities and terminals for remote alarm signal.
- When an alarm condition has had the audible alarm muted, ensure that terminals for a remote "alarm accepted" light are energised. The audible alarm circuit and terminals for remote alarm signal must still be capable of indicating another fault occurring even though original fault has not been cleared. The test facilities are to test momentarily both the audible alarm and all alarm indicator lamps, whilst the push button is depressed.
- Use alarms that interface with a sensor or controller to sense set-point and measured value. Provide adjustable upper and lower limits on face of unit. Provide unit with indicating lamps to show which limit has been exceeded. Provide each unit with connections for remote alarm.

2250A PROGRAMMABLE LOGIC CONTROLLERS:
- Provide programmable logic controllers in accordance with the manufacturer's recommendations and the specified control requirements.
- Standard - BS EN 61131.
  - Provide fuse and isolator for the Programmable Logic Controller. Install PLC with control components.
  - Programming language standard - BS EN 61131-3

2260A STARTER AND CONTROL PANEL INTERNAL WIRING:
- Standard
  - BS 6231 for polyvinyl chloride (PVC) tri-rated switchgear cable
  - BS EN 50525-3-41 for Low Smoke Zero Halogen (LSZH) cable
- Wiring coding, selection, installation and termination to BS EN 60445, BS EN 61439-series, BS EN 60204-1 and BS 7671, as relevant.
- Control wiring
  - Segregate control and auxiliary contact wiring from power circuits. Contain control wiring in slotted plastic trunking.
  - Provide electrical separation for voltages of different bands in accordance with BS 7671, BS EN 60204-1 and BS EN 61439-series as relevant.
- Power wiring
  - Take account of thermal effects of grouping when routing power wiring.
- All wires
  - Identify each end of each wire with a unique wire number according to the control panel drawings and cable schedule.
  - Terminate wiring intended for screw terminals with ferrules to facilitate fault-finding and maintenance replacement.

2270A COMPONENT MOUNTING:
- Mount all components of the switchgear and controlgear in accordance with the manufacturer's instructions.
- Mount control components on top hat rails dimensional type TH 35-7,5 to BS EN 60715. Steel rails to be manufactured and finished in accordance with Appendix A to BS EN 60715

2280A CONTROL SYSTEM FUNCTION CHARTS:
- Prepare function charts for the control system in accordance with BS EN 60848. Obtain approval of function chart before design of system hardware or writing control software.
  - Function chart format - Combined function chart/circuit diagram.

3010 INSTALLATION:
- Install control panels, Motor Control Centre (MCC)s, contactors and starters in accordance with BS EN 60947 and manufacturer's recommendations.

BS APPENDIX

BS 88-3:2010
Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household or similar applications). Examples of standardized systems of fuses A to F.

BS 88-4:1988
Cartridge fuses for voltages up to and including 1000 V a.c. and 1500 V d.c. Part 4 Specification of supplementary requirements for fuse-links for the protection of semiconductor devices

BS 6231:2006
Electric cables. Single core PVC insulated flexible cables of rated voltage 600/1000V for switchgear and controlgear wiring.

BS 7671:2018
Requirements for electrical installations. IET Wiring Regulations

BS EN 842:1996+A1:2008
Safety of machinery. Visual danger signals. General requirements, design and testing

BS EN 50525-3-41:2011
Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U). Cables with special fire performance. Single core non-sheathed cables with halogen-free crosslinked insulation, and low emission of smoke

BS EN 60038:2011
CENELEC standard voltages

BS EN 60068-1:2014
Environmental testing. General and guidance

BS EN 60068-2-1:2007
Environmental testing. Tests. Test A. Cold

BS EN 60068-2-2:2007
Environmental testing. Tests. Test B. Dry heat

BS EN 60068-2-5:2011
Environmental testing. Tests. Test Sa. Simulated solar radiation at ground level and guidance for solar radiation testing

BS EN 60068-2-6:2008
Environmental testing. Tests. Test Fc. Vibration (sinusoidal)

BS EN 60068-2-7:1993
Environmental testing. Test methods. Test Ga and guidance. Acceleration, steady state

BS EN 60068-2-10:2005
Environmental testing. Tests. Test J and guidance: Mould growth

BS EN 60068-2-11:1999
Environmental testing. Test methods. Tests. Test KA. Salt mist

BS EN 60068-2-13:1999
Environmental testing. Test methods. Tests. Test M. Low air pressure

BS EN 60068-2-14:2009
Environmental testing. Tests. Test N. Change of temperature

BS EN 60068-2-17:1995
Environmental testing. Test methods. Test Q. Sealing

BS EN 60068-2-18:2017
Environmental testing. Tests. Tests R and guidance: Water

BS EN 60068-2-20:2008
Environmental testing. Tests. Test T. Test methods for solderability and resistance to soldering heat of devices with leads

BS EN 60068-2-21:2006
Environmental testing. Tests. Test U: Robustness of terminations and integral mounting devices

BS EN 60068-2-27:2009
Environmental testing. Tests. Test Ea and guidance. Shock

BS EN 60068-2-30:2005
Environmental testing. Tests. Test Db and guidance: Damp heat, cyclic (12 h + 12 h cycle)

BS EN 60068-2-31:2008
Environmental testing. Tests. Test Ec. Rough handling shocks, primarily for equipment-type specimens

BS EN 60068-2-38:2009
Environmental testing. Tests. Test Z/AD. Composite temperature/humidity cyclic test

BS EN 60068-2-39:2016
Environmental testing. Tests. Tests and guidance. Combined temperature or temperature and humidity with low air pressure tests

BS EN 60068-2-40:2000
Environmental testing. Test methods. Test Z/AM. Combined cold/low air pressure tests

BS EN 60068-2-41:2000
Environmental testing. Test methods. Tests. Test Z/BM: Combined dry heat/low air pressure tests

BS EN 60068-2-42:2003
Environmental testing. Test methods. Test Kc. Sulphur dioxide test for contacts and connections

BS EN 60068-2-43:2003
Environmental testing. Test methods. Test Kd. Hydrogen sulphide test for contacts and connections

BS EN 60068-2-45:1993
Environmental testing. Test methods. Environmental testing. Tests. Test XA and guidance. Immersion in cleaning solvents

BS EN 60068-2-47:2005
Environmental testing. Tests. Mounting of specimens for vibration, impact and similar dynamic tests

BS EN 60068-2-48:2000
Environmental testing. Test methods. Guidance on the application of the tests of IEC 60068 to simulate the effects of storage

BS EN 60068-2-52:1996
Environmental testing. Test methods. Tests. Test Kb. Salt mist cyclic (sodium chloride solution)

BS EN 60068-2-53:2010
Environmental testing. Tests and guidance. Combined climatic (temperature/humidity) and dynamic (vibration/shock) tests

BS EN 60068-2-55:2013
Environmental testing. Tests. Test Ee and guidance. Loose cargo testing including bounce

BS EN 60068-2-57:2013
Environmental testing. Tests. Test Ff: Vibration. Time-history and sine-beat method

BS EN 60068-2-58:2015
Environmental testing. Tests. Test Td. Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)

BS EN 60068-2-60:2015
Environmental testing. Tests. Test Ke: Flowing mixed gas corrosion test

BS EN 60068-2-61:1994
Environmental testing. Test methods. Test Z/ABDM. Climatic sequence

BS EN 60068-2-64:2008
Environmental testing. Tests. Test Fh. Vibration, broadband random and guidance

BS EN 60068-2-65:2013
Environmental testing. Tests. Test Fg: Vibration. Acoustically induced method

BS EN 60068-2-66:1995
Environmental testing. Test methods. Test Cx. Damp heat, steady state (unsaturated pressurized vapour)

BS EN 60068-2-67:1996
Environmental testing. Test methods. Test Cy. Damp heat, steady state, accelerated test primarily intended for components

BS EN 60068-2-68:1996
Environmental testing. Test methods. Test L. Dust and sand

BS EN 60068-2-69:2017
Environmental testing. Tests. Test Te/Tc. Solderability testing of electronic components and printed boards by the wetting balance (force measurement) method

BS EN 60068-2-70:1996
Environmental testing. Test methods. Test Xb. Abrasion of markings and letterings caused by rubbing of fingers and hands

BS EN 60068-2-74:2000
Environmental testing. Test methods. Test Xc: Fluid contamination

BS EN 60068-2-75:2014
Environmental testing. Tests. Test Eh: Hammer tests

BS EN 60068-2-77:1999
Environmental testing. Test methods. Body strength and impact shock

BS EN 60068-2-78:2013
Environmental testing. Tests. Test Cab: Damp heat, steady state

BS EN 60068-2-80:2005
Environmental testing. Tests. Test Fi: Vibration. Mixed mode

BS EN 60068-2-81:2003
Environmental testing. Test methods. Test Ei. Shock. Shock response spectrum synthesis

BS EN 60068-2-82:2007
Environmental testing. Tests. Test Tx. Whisker test methods for electronic and electric components

BS EN 60068-2-83:2011
Environmental testing . Tests. Test Tf: Solderability testing of electronic components for surface mounting devices (SMD) by the wetting balance method using solder paste

BS EN 60068-3-1:2011
Environmental testing. Supporting documentation and guidance. Cold and dry heat tests

BS EN 60068-3-2:1999
Environmental testing. Guidance. Combined temperature/low air pressure tests. Combined temperature/low air pressure tests

BS EN 60068-3-3:1993
Environmental testing. Guidance. Environmental testing. Miscellaneous. Guide to seismic test methods for equipment

BS EN 60068-3-4:2002
Environmental testing. Supporting documentation and guidance. Damp heat tests

BS EN 60068-3-5:2002
Environmental testing. Guidance. Confirmation of the performance of temperature chambers

BS EN 60068-3-6:2002
Environmental testing. Guidance. Confirmation of the performance of temperature/humidity chambers

BS EN 60068-3-7:2002
Environmental testing. Guidance. Measurements in temperature chambers for tests A and B (with load)

BS EN 60068-3-8:2003
Environmental testing. Supporting documentation and guidance. Selecting amongst vibration tests

BS EN 60068-3-11:2007
Environmental testing. Supporting documentation and guidance. Calculation of uncertainty of conditions in climatic test chambers

BS EN 60068-3-13:2016
Environmental testing. Supporting documentation and guidance on Test T. Soldering

BS EN 60068-5-2:2000
Environmental testing. Guide to drafting of test methods. Terms and definitions

BS EN 60073:2002
Basic and safety principles for man-machine interface, marking and identification. Coding principles for indicators and actuators

BS EN 60204-1:2018
Safety of machinery. Electrical equipment of machines. Part 1 General requirements

BS EN 60204-1:2018
Safety of machinery. Electrical equipment of machines. Part 1 General requirements

BS EN 60204-11:2000
Safety of machinery. Electrical equipment of machines. Requirements for HV equipment for voltages above 1000 V a.c. or 1500 V d.c. and not exceeding 36 kV

BS EN 60204-31:2013
Safety of machinery. Electrical equipment of machines. Particular safety and EMC requirements for sewing machines, units and systems

BS EN 60204-32:2008

Safety of machinery. Electrical equipment of machines. Requirements for hoisting machines

BS EN 60204-33:2011
Safety of machinery. Electrical equipment of machines. Requirements for semiconductor fabrication equipment

BS EN 60269-1:2007+A2:2014
Low-voltage fuses. Part 1 General requirements

BS EN 60269-4:2009+A2:2016
Low-voltage fuses. Part 4 Supplementary requirements for fuse-links for the protection of semiconductor devices

BS EN 60269-6:2011
Low-voltage fuses. Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems

BS EN 60445:2017
Basic and safety principles for man-machine interface, marking and identification. Identification of equipment terminals, conductor terminations and conductors

BS EN 60529:1992+A2:2013
Degrees of protection provided by enclosures (IP code)

BS EN 60715:2017
Dimensions of low-voltage switchgear and controlgear. Standardized mounting on rails for mechanical support of switchgear, controlgear and accessories.

BS EN 60848:2013
GRAFCET specification language for sequential function charts

BS EN 60947-1:2007+A2:2014
Low-voltage switchgear and controlgear. Part 1 General rules

BS EN 60947-2:2017
Low-voltage switchgear and controlgear. Part 2 Circuit-breakers

BS EN 60947-3:2009+A2:2015
Low-voltage switchgear and controlgear. Part 3 Switches, disconnectors, switch-disconnectors and fuse-combination units

BS EN 60947-3:2009+A2:2015
Low-voltage switchgear and controlgear. Part 3 Switches, disconnectors, switch-disconnectors and fuse-combination units

BS EN 60947-4-1:2010+A1:2012
Low-voltage switchgear and controlgear. Part 4-1 Contactors and motor-starters. Electromechanical contactors and motor-starters

BS EN 60947-4-1:2010+A1:2012
Low-voltage switchgear and controlgear. Part 4-1 Contactors and motor-starters. Electromechanical contactors and motor-starters

BS EN 60947-4-2:2012
Low-voltage switchgear and controlgear. Part 4-2 Contactors and motor-starters. A.C. semiconductor motor controllers and starters

BS EN 60947-4-2:2012
Low-voltage switchgear and controlgear. Part 4-2 Contactors and motor-starters. A.C. semiconductor motor controllers and starters

BS EN 60947-4-3:2014
Low-voltage switchgear and controlgear. Contactors and motor-starters. AC semiconductor controllers and contactors for non-motor loads

BS EN 60947-4-3:2014
Low-voltage switchgear and controlgear. Contactors and motor-starters. AC semiconductor controllers and contactors for non-motor loads

BS EN 60947-5-1:2017
Specification for low-voltage switchgear and controlgear. Part 5-1 Control/circuit devices and switching elements. Electromechanical control circuit devices

BS EN 60947-5-1:2017
Specification for low-voltage switchgear and controlgear. Part 5-1 Control/circuit devices and switching elements. Electromechanical control circuit devices

BS EN 60947-5-2:2007+A1:2012
Low-voltage switchgear and controlgear. Control circuit devices and switching elements. Proximity switches

BS EN 60947-5-3:2013
Low-voltage switchgear and controlgear. Control circuit devices and switching elements. Requirements for proximity devices with defined behaviour under fault conditions (PDDB)

BS EN 60947-5-4:2003
Specification for low-voltage switchgear and controlgear. Part 5-4 Control circuit devices and switching elements. Method of assessing the performance of low-energy contacts. Special tests

BS EN 60947-5-5:1998+A2:2017
Low-voltage switchgear and controlgear. Part 5-5: Control circuit devices and switching elements - Electrical emergency stop device with mechanical latching function

BS EN 60947-5-6:2001
Specification for low-voltage switchgear and controlgear. Control circuit devices and switching elements. DC interface for proximity sensors and switching amplifiers (NAMUR). DC interface for proximity sensors and switching amplifiers (NAMUR)

BS EN 60947-5-7:2003
Specification for low-voltage switchgear and controlgear. Control circuit devices and switching elements. Requirements for proximity devices with analogue output

BS EN 60947-5-8:2006
Low-voltage switchgear and controlgear. Control circuit devices and switching elements. Three-position enabling switches

BS EN 60947-5-9:2007
Low-voltage switchgear and controlgear. Control circuit devices and switching elements. Flow rate switches

BS EN 60947-6-1:2005+A1:2014
Low-voltage switchgear and controlgear. Multiple function equipment. Transfer switching equipment

BS EN 60947-6-2:2003
Specification for low-voltage switchgear and controlgear. Part 6-2 Multiple function equipment. Control and protective switching devices (or equipment) (CPS)

BS EN 60947-7-1:2009
Low-voltage switchgear and controlgear. Ancillary equipment. Terminal blocks for copper conductors

BS EN 60947-7-2:2009
Low-voltage switchgear and controlgear. Ancillary equipment. Protective conductor terminal blocks for copper conductors

BS EN 60947-7-3:2009
Low-voltage switchgear and controlgear. Ancillary equipment. Safety requirements for fuse terminal blocks

BS EN 60947-7-4:2013
Low-voltage switchgear and controlgear. Ancillary equipment. PCB terminal blocks for copper conductors

BS EN 60947-8:2003+A2:2012
Specification for low-voltage switchgear and controlgear. Part 8 Control units for built-in thermal protection (PTC) for rotating electrical machines

BS EN 61000-3-12:2011
Electromagnetic compatibility (EMC). Limits. Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase

BS EN 61131-1:2003
Programmable controllers. Part 1 General information

BS EN 61131-2:2007
Programmable controllers. Part 2 Equipment requirements and tests

BS EN 61131-3:2013
Programmable controllers. Part 3 Programming languages

BS EN 61131-5:2001
Programmable controllers. Part 5 Communications

BS EN 61131-6:2012
Programmable controllers. Functional safety

BS EN 61131-7:2001
Programmable controllers. Part 7 Fuzzy control programming

BS EN 61131-9:2013
Programmable controllers. Single-drop digital communication interface for small sensors and actuators (SDCI)

BS EN 61439-1:2011
Low-voltage switchgear and controlgear assemblies. Part 1 General rules

BS EN 61439-2:2011
Low-voltage switchgear and controlgear assemblies. Power switchgear and controlgear assemblies

BS EN 61439-3:2012
Low-voltage switchgear and controlgear assemblies. Distribution boards intended to be operated by ordinary persons (DBO)

BS EN 61439-4:2013
Low-voltage switchgear and controlgear assemblies. Particular requirements for assemblies for construction sites (ACS)

BS EN 61439-5:2015
Low-voltage switchgear and controlgear assemblies. Assemblies for power distribution in public networks

BS EN 61439-6:2012
Low-voltage switchgear and controlgear assemblies. Busbar trunking systems (busways)

BS EN 61558-1:2005+A1:2009
Safety of power transformers, power supplies, reactors and similar products. Part 1 General requirements and tests

BS EN 61558-2-2:2007
Safety of power transformers, power supplies, reactors and similar products. Part 2-2 Particular requirements and tests for control transformers and power supplies incorporating control transformers

BS EN 61800-1:1998
Adjustable speed electrical power drive systems. Part 1 Rating specifications for low voltage adjustable speed d.c. power drive systems

BS EN 61800-2:2015
Adjustable speed electrical power drive systems. General requirements. Rating specifications for low voltage adjustable speed a.c. power drive systems

BS EN 61800-4:2003
Adjustable speed electrical power drive systems. Part 4 General requirements. Rating specifications for a.c. power drive systems above 1 000 V a.c. and not exceeding 35 kV

BS EN 61800-5-1:2007+A1:2017
Adjustable speed electrical power drive systems. Part 5-1 Safety requirements - Electrical, thermal and energy

BS EN 61800-5-2:2017
Adjustable speed electrical power drive systems. Safety requirements. Functional

BS EN 61800-7-1:2016
Adjustable speed electrical power drive systems. Generic interface and use of profiles for power drive systems. Interface definition

BS EN 61800-7-201:2016
Adjustable speed electrical power drive systems. Generic interface and use of profiles for power drive systems. Profile type 1 specification

BS EN 61800-7-202:2016
Adjustable speed electrical power drive systems. Generic interface and use of profiles for power drive systems. Profile type 2 specification

BS EN 61800-7-203:2016
Adjustable speed electrical power drive systems. Generic interface and use of profiles for power drive systems. Profile type 3 specification

BS EN 61800-7-204:2016
Adjustable speed electrical power drive systems. Generic interface and use of profiles for power drive Systems. Profile type 4 specification

BS EN 61800-7-301:2016
Adjustable speed electrical power drive systems. Generic interface and use of profiles for power drive systems. Mapping of profile type 1 to network technologies

BS EN 61800-7-302:2016
Adjustable speed electrical power drive systems. Generic interface and use of profiles for power drive systems. Mapping of profile type 2 to network technologies

BS EN 61800-7-303:2016

Adjustable speed electrical power drive systems. Generic interface and use of profiles for power drive systems. Mapping of profile type 3 to network technologies

BS EN 61800-7-304:2016
Adjustable speed electrical power drive systems. Generic interface and use of profiles for power drive systems. Mapping of profile type 4 to network technologies

BS EN 61800-9-1:2017
Adjustable speed electrical power drive systems. Ecodesign for power drive systems, motors starters, power electronics and their driven applications. General requirements for setting energy efficiency standards for power driven equipment using extended product approach (EPA) and semi analytic model (SAM)

BS EN 61800-9-2:2017
Adjustable speed electrical power drive systems. Ecodesign for power drive systems, motor starters, power electronics and their driven applications. Energy efficiency indicators for power drive systems and motor starters

BS EN 62208:2011
Empty enclosures for low-voltage switchgear and controlgear assemblies. General requirements

BS EN 62626-1:2014
Low-voltage switchgear and controlgear enclosed equipment. Enclosed switch-disconnectors outside the scope of IEC 60947-3 to provide isolation during repair and maintenance work

Y82 IDENTIFICATION - ELECTRICAL

2010A LABELS AND NOTICES:
- Apply identification labels and notices in accordance with BS 7671 (IET Wiring Regulations), Section 514 to all electrical cables plant and equipment including components of mechanical systems.
- BS 7671 labels and notices
- Identification of protective devices.
  - Diagrams, charts or tables to comply with Clauses 514.9 and 560.7.9, 560.7.10 and 560.7.11
  - Warning notices, voltages in excess of 230 volts to earth
  - Periodic inspection and test notices.
  - Residual current device quarterly test notices.
  - Earth electrode safety electrical connection label.
  - Bonding conductor connector point to extraneous conductive parts label.
  - Earth free local equipotential bonding areas warning notice.
  - Electrical separation areas warning notice.
  - Outdoor equipment socket outlet notice.
  - Operating instructions to comply with Clause 560.7.12.
  - Warning notice, non-standard wiring colours.
  - Warning notices, alternative sources of supply.

2020A MATERIALS:
- Use materials for labels and notices with a predicted life equal to or greater than the design life of the electrical cables, plant, equipment or installation to which it refers.
- External
  - Signwritten, or stencil in paint compatible with surface.
  - Colour - Background, plant standard finish. Lettering, white.
- Internal
  - Engraved thermosetting plastic laminate.
  - Colour - Background, white or red. Lettering, red or white.

2030A FIXING - INTERNAL:
- Fix labels and notices using materials compatible with label or notice and surface to which it is fixed by screws into tapped hole or bolted complete with washer nut and locking device.

2040A ARRANGEMENT:
- Obtain approval prior to manufacture, with regard to style, colour, lettering, size and position of all labels and notices.
  - Provide sample showing style, colour, lettering and size, for approval.

2050A LETTERING AND SIZE OF LABELS AND NOTICES:
- Ensure that all lettering and symbols comply with the requirements laid out in BS ISO 3864-1 for height of lettering where not otherwise indicated. Ensure labels and notices of adequate size for the lettering required, and allow a minimum margin around all lettering of one line space vertically and two letter spacing horizontally.
- Font - Helvetica Medium.
- Size - 5mm minimum high letters.

2060A CONDUCTOR ARRANGEMENT:
- Arrange circuit polarity so that phases read in phase rotation order followed by the neutral, if any, from top to bottom in horizontal conductor layouts and left to right in vertical conductor layouts. Ensure flat horizontal arrays have leading phase to the left and neutral to the right from left to right when viewed from supply point. Arrange phase or live pole of two wire apparatus at top or left hand and neutral and earth both at bottom or right hand side. In all cases, ensure conductor arrangements defined are when viewed from front face of all equipment and terminating facilities. Apply identification markers in accordance with BS 7671 (IET Wiring Regulations), section 514 to all conductor termination points.

2080A PLANT AND EQUIPMENT LABELS:

• Fit labels on all items of plant, equipment, switches, etc., include the following information: service controlled, circuit reference, voltage, type of supply and phase etc., circuit protection type and rating.

2090 MAINTENANCE NOTICES:
• Fix notices giving warning of, and instructions on, any special maintenance procedures to plant and equipment.

2110A MOTORS AND STARTERS LABELS:
• Fit identification labels to all motors, starters and starter panels. Ensure positive identification of respective motors and starters. Provide motors with non-corrodible labels attached adjacent to each bearing giving details of the lubricant to be used. Mark direction of normal rotation on motor casing. Provide labels to identify motor equipment fitted with surge suppressors and thermistors stating that insulation test voltages must not be applied to thermistors and thermistor control units. Ensure labelling is compatible with schematic and wiring diagrams, and complies with BS EN 60034-8.

2120A LABELLED ACCESSORY PLATES - ENGRAVED:
• Label accessory plates, including lighting switches, socket outlets and connection units to indicate their use. Label by engraving, lettering 6mm high colour red.

2150A SCHEMATIC DIAGRAMS:
• Provide a purpose made schematic diagram permanently fixed showing the connections of the equipment and plant.
• Locations and materials as indicated in contract preliminaries.

2160 SPECIAL PURPOSE EARTHING:
• Fit labels to special purpose earthing conductors and connection points, describing their purposes and any instructions necessary for their operation and maintenance.
• Earthing and bonding networks for buildings with telecommunications, information technology and control system installations in accordance with BS EN 50310 and BS 7671.
• Telecommunications functional earths as BS 6701.

2170A INDICATOR LAMPS AND PUSH BUTTONS FOR POWER SYSTEMS:
• Use indicator lamp and push button colours in accordance with BS EN 60073.
Indicator lamp
  • Red, danger or alarm; yellow, caution; green, safety.
• Push buttons
  • Red, emergency action; red, stop or off; yellow, intervention; green, start or on.
• Illuminated push buttons - Type a.

2180A CONDUIT AND TRUNKING COLOUR CODING:
• In areas of mechanical plant or voids accommodating mechanical services, or where otherwise indicated, identify electrical conduits and ducts in accordance with BS 1710. Apply colour orange to BS 4800 by painting on service as a band over 150mm or applying an adhesive tape type wrap around services over a length of 150mm.
• Place identification colours at bulkheads, wall penetrations and any other place where identification is necessary.

2190A CABLE IDENTIFICATION:
• Provide all cables, other than final sub-circuit wiring enclosed in conduits or trunking, with labels fixed at each end of cable either side of wall and floor penetrations at approximately 12m intervals at convenient inspection points by means of non-releasable plastic straps, minimum width 4mm.
• Ensure labels show the reference number of cable.

2200A TERMINAL MARKING AND CONDUCTOR IDENTIFICATION:
• Provide for switchgear and control gear elements whose terminals are marked in accordance with BS 5472 (EN 50005) and BS 6272 (EN 50042). Use a unique reference to identify each element in the switchgear or control gear. Mark on or adjacent to each element its reference. Identify each terminal for connection to external wiring or cabling using a reference system complying with BS EN 60445 based on the element reference and the appropriate element terminal reference.

- Adjacent to terminals.
- Use lettered or numbered ferrules or sleeves to BS 3858 to mark each auxiliary conductor or control cable core with the identity of the terminal to which it is connected and the reference of plant or equipment to which it is connected and the identity of the terminal at the remote end. Ensure that main circuit conductors are identified in accordance with BS 7671 (IET Wiring Regulations) Section 514. Ensure that all identification of terminals and conductors is recorded and included on record drawings and in operation and maintenance documentation.

2220A CABLE CONDUCTOR COLOUR CODING:
- Identify cable conductors in accordance with BS 7671 (IET Wiring Regulations) Section 514 and Appendix 7, note that a lighting sub-circuit switch wire is a phase conductor in a single-phase circuit.

2230 CABLE JOINTING AND TERMINATION:
- Connect all cables in the installation so that the correct sequence of phase rotation is maintained throughout. Where straight through joints are approved joint medium voltage conductors as they lie, ensuring their complete length is phased out on completion. Ensure connections at terminations of MV cables are made in the correct phase rotation and ensure cable conductor termination marking if any, complies with this phase sequence. Where straight through joints are approved on low voltage cables, whether power cables or control or auxiliary cables, joint conductors strictly in accordance with their colour or numeric coding. Where such joints are approved on mineral insulated or other non-coded conductor cables, identify each core at the joint and make the joint core to core.

BS APPENDIX

BS 1710:2014
Specification for identification of pipelines and services

BS 3858:1992
Specification for binding and identification sleeves for use on electric cables and wires

BS 4800:2011
Schedule of paint colours for building purposes

BS 5472:1977
Specification for low voltage switchgear and controlgear for industrial use. Terminal marking and distinctive number. General rules

BS 5499-10:2014
Guidance for the selection and use of safety signs and fire safety notices

BS 6272:1982
Specification for low voltage switchgear and controlgear for industrial use. Terminal marking. Terminals for external associated electronic circuit components and contacts

BS 6701:2016+A1:2017
Telecommunications equipment and telecommunications cabling. Specification for installation, operation and maintenance

BS 7671:2018
Requirements for electrical installations. IET Wiring Regulations

BS EN 50310:2016
Telecommunications bonding networks for buildings and other structures

BS EN 60034-8:2007+A1:2014
Rotating electrical machines. Terminal markings and direction of rotation

BS EN 60073:2002
Basic and safety principles for man-machine interface, marking and identification. Coding principles for

indicators and actuators

BS EN 60445:2017
Basic and safety principles for man-machine interface, marking and identification. Identification of equipment terminals, conductor terminations and conductors

BS EN 61439-1:2011
Low-voltage switchgear and controlgear assemblies. Part 1 General rules

BS EN 61439-2:2011
Low-voltage switchgear and controlgear assemblies. Power switchgear and controlgear assemblies

BS EN 61439-3:2012
Low-voltage switchgear and controlgear assemblies. Distribution boards intended to be operated by ordinary persons (DBO)

BS EN 61439-4:2013
Low-voltage switchgear and controlgear assemblies. Particular requirements for assemblies for construction sites (ACS)

BS EN 61439-5:2015
Low-voltage switchgear and controlgear assemblies. Assemblies for power distribution in public networks

BS EN 61439-6:2012
Low-voltage switchgear and controlgear assemblies. Busbar trunking systems (busways)

BS EN ISO 7010:2012+A7:2017
Graphical symbols. Safety colours and safety signs. Registered safety signs

BS ISO 3864-1:2011
Graphical symbols. Safety colours and safety signs. Design principles for safety signs and safety markings

BS ISO 3864-3:2012
Graphical symbols. Safety colours and safety signs. Design principles for graphical symbols for use in safety signs

BS ISO 3864-4:2011
Graphical symbols. Safety colours and safety signs. Colorimetric and photometric properties of safety sign materials

Y90 FIXING TO BUILDING FABRIC

1010 PREPARATION:
- Mark-out, set-out and firmly fix all equipment, components and necessary brackets and supports.

1020 MANUFACTURER'S DRAWINGS:
- Use manufacturer's drawings and templates for purposes of marking and setting out.

1030 FIXINGS:
- Ensure structure and fixings are suitable for items to be fixed.

1040 LOADING DETAILS:
- Provide loading details for all fixing types.

1050 BUILDING-IN BY OTHERS:
- Provide all necessary assistance to enable any item of building-in type to be built in by others.

1060 SIZE OF FIXING:
- Use largest size of bolt, screw or other fixing permitted by diameter of hole in item to be fixed.

1070 GREASING OF FIXINGS:
- Ensure all bolts, screws or other fixings used are greased or lubricated in accordance with manufacturer's instructions.

2010 STANDARDS:
- Ensure that fixings such as expanding anchors are tested for tensile loading in accordance with BS 5080-1.

2020 PLUGS:
- Use plugs of suitable size and length for fixings. Use plastic, fibrous or soft metal non-deteriorating plugs to suit application. Do not use wood plugs.
- Ensure that when screw is in place, threaded length is in plug. Ensure plugs used for screw fixing are set-in to correct depth prior to final tightening.

2030 SCREWS:
- Use screws to BS 1210. Generally use sheradised steel wood screws for fixing to concrete, brickwork or blockwork.
- In damp or exposed situations use greased brass wood screws.

2080 NON-PENETRATIVE SUPPORT SYSTEMS FOR ROOF MOUNTED EQUIPMENT:
- Obtain approval prior to using non-penetrative support systems for roof mounted equipment.

3010 DRILLING:
- Drill holes squarely. Use drills of requisite size and depth, and appropriate to fabric. Do not flame-cut holes in metal work.

3050 FIXING TO TIMBER RAILS:
- Fix equipment, brackets and supports by drilling hole through timber rail and fixing with bolt, back plate, washer and loose nut.

3060A FIXING TO HOLLOW STUD/TILE/BLOCK WALLS:
- Fix equipment, brackets and supports where there is access at rear of wall, by drilling hole through wall and fixing with bolt, back-plate, washer and loose nut.
- Fix equipment, brackets and supports where there is no access at rear of wall, drill hole and use screw anchor type fixing or gravity type toggle fixing.

3070A FIXING TO CONCRETE, BRICKWORK OR BLOCKWORK:
- Fix equipment, brackets and supports using wood screws in plugs or, as appropriate, drill holes and fix using steel bolts of grouted bolt type or expanding bolt type fixing.

3080A FIXING TO METALWORK:
- Fix equipment, brackets and supports by drilling holes and fixing using set screws or bolts complete with washers, shakeproof washers and loose nuts.

3090A FIXING TO STRUCTURAL STEELWORK AND CONCRETE STRUCTURES:
- Provide manufacturer's information on recommended fixing. Obtain approval for any fixing to structure steel work and concrete structures.
- Generally use proprietary fixings to structural steelwork and concrete structures.
- Obtain approval to cut holes in structural steelwork or concrete structures or weld to structural steelwork.

BS APPENDIX

BS 1210:1963
Specification for wood screws.
Current, Work In Hand, Obsolescent

BS 5080-1:1993
Structural fixings in concrete and masonry. Part 1 Method of test for tensile loading

Y91 PAINTING AND ANTI-CORROSION TREATMENTS

1010 GENERAL REQUIREMENTS:
- Ensure, where particular methods of finish and painting are not specified, the following requirements are met.
- Protect all metal work, plant, equipment, pipelines, ductlines, ancillaries, brackets and supports against corrosion and oxidization.
- Provide ferrous metals, machined or otherwise with protective coatings at manufacturer's works.
- Ensure all items requiring on-site decorative finishes are provided primed to suit base material and required finish.

1020 DAMAGED FINISHES:
- Following delivery to site, storage on-site and installation make good any damage to finishes, by cleaning, degreasing and re-furbishing.

2010A PAINT MATERIALS:
- Use the following materials as appropriate
  - Solvent borne priming paint to BS 7956 for bare woodwork.
  - Red Oxide priming paint for bare iron and steelwork.
  - Zinc Chromate priming paint for bare ferrous and non-ferrous metals.
  - Calcium Plumbate priming paint to BS 3698 for galvanized steel or composite wood/metal components.
  - Undercoat paint for previously primed or painted surfaces before the application of finishing coats.
  - Gloss finishing paint for previously primed or painted/undercoated surfaces.
  - Epoxy resin paint for specialist coatings requiring resistance to acids, alkalis, oils, solvents, abrasion or high humidity.
  - Aluminium paint to BS 388 for structural steelwork, storage vessels, heated metallic surfaces and similar applications where moisture and heat resistant properties are required.
  - Cold galvanizing paint for making good damage to previously galvanized surfaces and protection to galvanized materials modified during installation.
  - Zinc-rich metallic to BS 4652 for bare iron and steelwork where electrical conductivity has to be assured.
  - Black tar-based paint to BS 1070 for moisture resistant protection to metal surfaces where decorating appearance is not important.
  - Bitumen based coatings for cold application to BS 3416 protection to iron and steel, particularly pipelines and fittings for use in contact with potable water.
  - Bitumen based coatings for cold application to BS 6949 not to be used in contact with potable water.

2020 PAINT QUALITY:
- Ensure paints used are of quality and type to suit application and that:-
  - primers have good adhesion, covering power, rust-inhibiting and grain filling properties.
  - gloss finishing paints are of machine finish grade having high adhesion and high resistance to solvents, mineral oils, cutting oils, detergents, chipping and impact damage.

3020 WEATHER AND OTHER CONDITIONS:
- Do not apply paints where weather, temperature, humidity or other conditions may have a damaging effect upon finish or paint.

3030A CLEANING AND PREPARING STEEL SURFACES FOR PAINTING:
- Ensure metal surfaces are thoroughly cleaned, all mill and weld scale removed and finally degreased. Clean steel surfaces in accordance with BS EN ISO 8503 and prepare surfaces for painting in accordance with BS EN ISO 4618.

3030B CLEANING AND PREPARING SURFACES FOR PAINTING:
- Ensure metal surfaces are thoroughly cleaned, all mill and weld scale removed and finally degreased.
- Prepare surfaces for painting in accordance with BS EN ISO 4618.

3040 APPLICATION OFF-SITE:
- Wherever possible ensure paint finishes applied by component manufacturers are spray applied.

3050 APPLICATION:
- Apply paint evenly and ensure finish shows no excessive brush marks, grinning, runs, sagging, ropiness or other application defects.

3060 COLD GALVANIZING:
- Repair damage to galvanized components due to installation process, i.e. following cutting, drilling or welding, by applying 2 no. substantial coats of cold galvanizing paint.

3070 PROTECTION OF BRIGHT MACHINE PARTS:
- Apply a protective coating to all bright machined parts before despatch from works.
- Do not remove protective coatings unless required for installation, testing or commissioning purposes and in such cases reinstate upon completion.
- Repair any damaged protective coating or bright machined part, or where necessary replace damaged component.
- Use and apply metal coatings in accordance with manufacturer's instructions.
- Complete where possible all welding, drilling, bending and other work before metal coating.

BS APPENDIX

BS 388:1972
Specification for aluminium pigments

BS 1070:1993
Specification for black paint (tar-based)

BS 3416:1991
Specification for bitumen-based coatings for cold application, suitable for use in contact with potable water

BS 3698:1964
Specification for calcium plumbate priming paints

BS 4652:1995
Specification for zinc-rich priming paint (organic media)

BS 6949:1991
Specification for bitumen-based coatings for cold application excluding use in contact with potable water

BS 7956:2000
Specification for primers for woodwork

BS EN ISO 4618-3:2014
Paints and varnishes. Terms and definitions for coating materials. Part 3 Surface preparation and methods of application

BS EN ISO 4618:2014
Paints and varnishes. Terms and definitions

BS EN ISO 8503-5:2004
Preparation of steel substrates before application of paints and related products. Surface roughness characteristics of blast-cleaned steel substrates. Part 5 Replica tape method for the determination of the surface profile

Y92 MOTOR DRIVES - ELECTRIC

1010 STANDARDS:
- Supply and install motors in accordance with BS EN 50347, for dimensional requirements of general purpose 3-phase induction motors, relevant parts of BS EN 60034, BS EN 62262 and BS 4999 as appropriate; and local supply authority regulations.
- Electrical equipment intended for use in potentially hazardous areas / explosive atmospheres to comply with relevant parts of BS EN IEC 60079/BS EN 60079 and be tested, certified and marked that the equipment is fit for its intended purpose and that adequate information is supplied with it to ensure that it can be used safely.

1040A MANUFACTURER FITTED SURGE SUPPRESSORS:
- Supply built-in surge suppressors to star connected motors and to all motors subject to star-delta starting to limit peak voltage to 1200 volts. Fitted by manufacturer.

2010A STANDARD OPERATING CONDITIONS:
- Ensure motors, starters and ancillary equipment are suitable for operation at full capacity at heights above sea level not exceeding 1000m, with air cooling at an average temperature over 24 hours not exceeding 35°C dry bulb with maximum conditions of 40°C dry bulb and 50 per cent RH.

2020 MOTORS - GENERAL:
- Standard
  - Use motors which conform to BS EN 60034, as applicable, which operate at lowest possible speed, compatible with performance requirements.
  - Terminal markings and direction of rotation to be in accordance with BS EN 60034-8
  - Provide isolation during repair and maintenance work in accordance with BS EN 62626-1
- Comply with EC Regulation 640/2009 and amendment EU Regulation 4/2014 with regard to ecodesign requirements for electric motors.
- Ratings
  - Select maximum continuous rating (MCR) such that driven machine operates at correct speed or speeds at design duty.
- When running continuously at design rated duty, the temperature of the motor parts is within limits defined in BS EN 60034-1
- When provided with excess motor current (over-load) protection of thermal overcurrent release type, ensure operation is within tolerances of tripping as defined in BS EN 60947-4-1.

Insulation
- Use motors with Class 130 or 155 to BS EN 60085 insulation, with temperature rise as defined in BS EN 60085
- Conduit entry
  - Fit motor bodies with conduit entry terminal box or cable gland as required, and to suit type and size of cable being terminated.
- Comply with BS EN 60034-5 and BS EN 62262 to achieve the specified degrees of protection classification provided by the integral design.

2025A MOTOR EFFICIENCY:
- Supply an IE2 motor with a minimum efficiency compliant with BS EN 60034-30-1 as shown in the table below:

IE2 Motor Efficiency Limits (%) for 50 Hz: figures taken from BS EN 60034-30-1 Table 5				
Rated Power (kW)	No. of Poles/Synchronous Speed (RPM)			
	2/3000	4/1500	6/1000	8/750
0.12	53.6	59.1	50.6	39.8
0.18	60.4	64.7	56.6	45.9
0.20	61.9	65.9	58.2	47.4
0.25	64.8	68.5	61.6	50.6
0.37	69.5	72.7	67.6	56.1

0.40	70.4	73.5	68.8	57.2
0.55	74.1	77.1	73.1	61.7
0.75	77.4	79.6	75.9	66.2
1.1	79.6	81.4	78.1	70.8
1.5	81.3	82.8	79.8	74.1
2.2	83.2	84.3	81.8	77.6
3	84.6	85.5	83.3	80.0
4	85.8	86.6	84.6	81.9
5.5	87.0	87.7	86.0	83.8
7.5	88.1	88.7	87.2	85.3
11	89.4	89.8	88.7	86.9
15	90.3	90.6	89.7	88.0
18.5	90.9	91.2	90.4	88.6
22	91.3	91.6	90.9	89.1
30	92.0	92.3	91.7	89.8
37	92.5	92.7	92.2	90.3
45	92.9	93.1	92.7	90.7
55	93.2	93.5	93.1	91.0
75	93.8	94.0	93.7	91.6
90	94.1	94.2	94.0	91.9
110	94.3	94.5	94.3	92.3
132	94.6	94.7	94.6	92.6
160	94.8	94.9	94.8	93.0
200	95.0	95.1	95.0	93.5

2025B MOTOR EFFICIENCY:

- Supply a IE3 motor with a minimum efficiency compliant with BS EN 60034-30-1 as shown in the table below:

IE3 Motor Efficiency Limits (%) for 50 Hz: figures taken from BS EN 60034-30-1 Table 7				
Rated Power (kW)	No. of Poles/Synchronous Speed (RPM)			
	2/3000	4/1500	6/1000	8/750
0.12	60.8	64.8	57.7	50.7
0.18	65.9	69.9	63.9	58.7
0.20	67.2	71.1	65.4	60.6
0.25	69.7	73.5	68.6	64.1
0.37	73.8	77.3	73.5	69.3
0.40	74.6	78.0	74.4	70.1
0.55	77.8	80.8	77.2	73.0
0.75	80.7	82.5	78.9	75.0
1.1	82.7	84.1	81.0	77.7
1.5	84.2	85.3	82.5	79.7
2.2	85.9	86.7	84.3	81.9
3	87.1	87.7	85.6	83.5
4	88.1	88.6	86.8	84.8
5.5	89.2	89.6	88.0	86.2
7.5	90.1	90.4	89.1	87.3
11	91.2	91.4	90.3	88.6
15	91.9	92.1	91.2	89.6
18.5	92.4	92.6	91.7	90.1
22	92.7	93.0	92.2	90.6
30	93.3	93.6	92.9	91.3
37	93.7	93.9	93.3	91.8
45	94.0	94.2	93.7	92.2
55	94.3	94.6	94.1	92.5

75	94.7	95.0	94.6	93.1
90	95.0	95.2	94.9	93.4
110	95.2	95.4	95.1	93.7
132	95.4	95.6	95.4	94.0
160	95.6	95.8	95.6	94.3
200	95.8	96.0	95.8	94.6

2025C MOTOR EFFICIENCY:

• Supply an IE4 motor with a minimum efficiency compliant with BS EN 60034-30-1 as shown in the table below:

IE4 Motor Efficiency Limits (%) for 50 Hz: figures taken from BS EN 60034-30-1 Table 9				
Rated Power (kW)	No. of Poles/Synchronous Speed (RPM)			
	2/3000	4/1500	6/1000	8/750
0.12	66.5	69.8	64.9	62.3
0.18	70.8	74.7	70.1	67.2
0.20	71.9	75.8	71.4	68.4
0.25	74.3	77.9	74.1	70.8
0.37	78.1	81.1	78.0	74.3
0.40	78.9	81.7	78.7	74.9
0.55	81.5	83.9	80.9	77.0
0.75	83.5	85.7	82.7	78.4
1.1	85.2	87.2	84.5	80.8
1.5	86.5	88.2	85.9	82.6
2.2	88.0	89.5	87.4	84.5
3	89.1	90.4	88.6	85.9
4	90.0	91.1	89.5	87.1
5.5	90.9	91.9	90.5	88.3
7.5	91.7	92.6	91.3	89.3
11	92.6	93.3	92.3	90.4
15	93.3	93.9	92.9	91.2
18.5	93.7	94.2	93.4	91.7
22	94.0	94.5	93.7	92.1
30	94.5	94.9	94.2	92.7
37	94.8	95.2	94.5	93.1
45	95.0	95.4	94.8	93.4
55	95.3	95.7	95.1	93.7
75	95.6	96.0	95.4	94.2
90	95.8	96.1	95.6	94.4
110	96.0	96.3	95.8	94.7
132	96.2	96.4	96.0	94.9
160	96.3	96.6	96.2	95.1
200	96.5	96.7	96.3	95.4

2060A MOTORS - OVER TEMPERATURE PROTECTION, THERMISTORS:

• Fit positive temperature coefficient thermistors to BS EN 60034-11. Provide a minimum of 3 PTC thermistors in each motor with 2 ends terminated in motor terminal box clearly and permanently marked.

- For motors rated between 30kW and 75kW provide a single thermistor in each phase.
- For motors rated above 75kW provide two thermistors in each phase.

• Provide control unit to BS EN 60034 to motors fitted with thermistors. Interconnect control unit with thermistors and starter to trip starter when one or all of thermistors detect overheating.

2080A DIRECT LONG COUPLED DRIVES:

• Use an extended motor shaft coupled to machine or a flexible coupling connecting driving and driven shafts, incorporate suitable arrangements for aligning the two shafts.
• Mount motors on a substantial mild steel bed plate fixed to machine casing separately supported or supported entirely from the machine casing.

2090A GUARDS:
• Totally protect drives and couplings. Fit purpose made guards around all exposed or otherwise accessible drive shafts, pulleys, V-belts or couplings.
• Ensure guards comply with national or local safety codes, Acts and Bylaws and incorporate following features
  • Construction to BS EN ISO 12100 and generally of galvanized steel wire mesh
  • Stiffening within the guards to ensure rigidity and freedom from vibration
  • Allowance for prime mover adjustment during belt tensioning procedures
  • Temporary access to all shafts for use of Tachometer

BS APPENDIX

BS 4999-103:2004
General requirements for rotating electrical machines. Part 103 Specification for symbols

BS 4999-140:1987
General requirements for rotating electrical machines. Part 140 Specification for voltage regulation and parallel operation of a.c. synchronous generators

BS 4999-141:2004+A1:2010
General requirements for rotating electrical machines. Part 141 Specification for standard dimensions

BS 4999-145:1987
General requirements for rotating electrical machines. Part 145 Specification for winding terminations

BS 4999-147:1988
General requirements for rotating electrical machines. Part 147 Specification for dimensions of brushes and brush-holders for electrical machinery

BS EN 50347:2001
General purpose three-phase induction motors having standard dimensions and outputs. Frame numbers 56 to 315 and flange numbers 65 to 740

BS EN 60034-1:2010
Rotating electrical machines. Rating and performance

BS EN 60034-2-1:2014
Rotating electrical machines. Part 2-1 Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)

BS EN 60034-2-2:2010
Rotating electrical machines. Specific methods for determining separate losses of large machines from tests. Supplement to IEC 60034-2-1

BS EN 60034-3:2008
Rotating electrical machines. Part 3 Specific requirements for synchronous generators driven by steam turbines or combustion gas turbines

BS EN 60034-4:2008
Rotating electrical machines. Part 4 Methods for determining synchronous machine quantities from tests

BS EN 60034-5:2001
Rotating electrical machines. Part 5 Degrees of protection provided by the integral design of rotating

electrical machines (IP code). Classification

BS EN 60034-6:1994, IEC 60034-6:1991
Rotating electrical machines. Part 6 Methods of cooling (IC Code)

BS EN 60034-7:1993, IEC 60034-7:1992
Rotating electrical machines. Part 7 Classification of types of constructions and mounting arrangements (IM Code)

BS EN 60034-8:2007+A1:2014
Rotating electrical machines. Terminal markings and direction of rotation

BS EN 60034-9:2005
Rotating electrical machines. Part 9 Noise limits

BS EN 60034-11:2004
Rotating electrical machines. Part 11 Thermal protection

BS EN 60034-12:2017
Rotating electrical machines. Starting performance of single-speed three-phase cage induction motors

BS EN 60034-14:2004
Rotating electrical machines. Part 14 Mechanical vibration of certain machines with shaft heights 56 mm and higher. Measurement, evaluation and limits of vibration severity

BS EN 60034-15:2009
Rotating electrical machines. Part 15 Impulse voltage withstand levels of form-wound stator coils for rotating a.c. machines

BS EN 60034-16-1:2011
Rotating electrical machines. Excitation systems for synchronous machines. Definitions

BS EN 60034-18-1:2010
Rotating electrical machines. Part 18-1 Functional evaluation of insulation systems. General guidelines

BS EN 60034-18-21:2013
Rotating electrical machines. Part 18-21 Functional evaluation of insulation systems. Test procedures for wire-wound windings. Thermal evaluation and classification.

BS EN 60034-18-22:2001, IEC 60034-18-22:2000
Rotating electrical machines. Part 18-22 Functional evaluation of insulation systems. Test procedures for wire-wound windings. Classification of changes and insulation component substitutions

BS EN 60034-18-31:2012
Rotating electrical machines. Part 18-31 Functional evaluation of insulation systems. Test procedures for form-wound windings. Thermal evaluation and classification of insulation systems used in rotating machines

BS EN 60034-18-32:2010
Rotating electrical machines. Part 18-32 functional evaluation of insulation systems. Test procedures for form-wound windings. Evaluation by electrical endurance

BS EN 60034-18-34:2012
Rotating electrical machines. Part 18-34 functional evaluation of insulation systems. Test procedures for form-wound windings. Evaluation of thermomechanical endurance of insulation systems

BS EN 60034-18-41:2014
Rotating electrical machines. Partial discharge free electrical insulation systems (Type I) used in rotating electrical machines fed from voltage converters. Qualification and quality control tests

BS EN 60034-19:2014
Rotating electrical machines. Specific test methods for d.c. machines on conventional and rectifier-fed supplies

BS EN 60034-22:2009
Rotating electrical machines. Part 22 AC generators for reciprocating internal combustion (RIC) engine driven generating sets

BS EN 60034-26:2006
Rotating electrical machines. Effects of unbalanced voltages on the performance of three-phase cage induction motors

BS EN 60034-27-3:2016
Rotating electrical machines. Dielectric dissipation factor measurement on stator winding insulation of rotating electrical machines

BS EN 60034-28:2013
Rotating electrical machines. Part 28 test methods for determining quantities of equivalent circuit diagrams for three-phase low-voltage cage induction motors

BS EN 60034-29:2008
Rotating electrical machines. Part 29 Equivalent loading and superposition techniques. Indirect testing to determine temperature rise

BS EN 60034-30-1:2014
Rotating electrical machines. Efficiency classes of line operated AC motors (IE code)

BS EN 60034-30:2009
Rotating electrical machines. Efficiency classes of single-speed, three-phase, cage-induction motors (IE-code)

BS EN 60079-1:2014
Explosive atmospheres. Equipment protection by flameproof enclosures "d"

BS EN 60079-2:2014
Explosive atmosphere. Equipment protection by pressurized enclosure "p"

BS EN 60079-5:2015
Explosive atmospheres. Equipment protection by powder filling "q"

BS EN 60079-6:2015
Explosive atmospheres. Equipment protection by liquid immersion “o”

BS EN 60079-10-1:2015
Explosive atmospheres. Part 10-1 Classification of areas. Explosive gas atmospheres

BS EN 60079-10-2:2015
Explosive atmospheres. Classification of areas. Explosive dust atmospheres

BS EN 60079-11:2012
Explosive atmospheres. Part 11 Equipment protection by intrinsic safety "i"

BS EN 60079-13:2017
Explosive atmospheres. Equipment protection by pressurized room "p"

BS EN 60079-14:2014
Explosive atmospheres. Electrical installations design, selection and erection

BS EN 60079-15:2010
Explosive atmospheres. Part 15 Equipment protection by type of protection "n"

BS EN 60079-17:2014
Explosive atmospheres. Part 17 Electrical installations inspection and maintenance

BS EN 60079-18:2015+A1:2017
Explosive atmospheres. Equipment protection by encapsulation "m"

BS EN 60079-19:2011+A1:2015
Explosive atmospheres. Equipment repair, overhaul and reclamation

BS EN 60079-20-1:2010
Explosive atmospheres. Material characteristics for gas and vapour classification. Test methods and data

BS EN 60079-25:2010
Explosive atmospheres. Part 25 Intrinsically safe electrical systems

BS EN 60079-26:2015
Explosive atmospheres. Equipment with equipment protection level (EPL) Ga

BS EN 60079-27:2008
Explosive atmospheres. Fieldbus intrinsically safe concept (FISCO)

BS EN 60079-28:2015
Explosive atmospheres. Protection of equipment and transmission systems using optical radiation

BS EN 60079-29-1:2016
Explosive atmospheres. Gas detectors. Performance requirements of detectors for flammable gases

BS EN 60079-29-2:2015
Explosive atmospheres. Gas detectors. Selection, installation, use and maintenance of detectors for flammable gases and oxygen

BS EN 60079-29-3:2014
Explosive atmospheres. Gas detectors. Guidance on functional safety of fixed gas detection systems

BS EN 60079-29-4:2010
Explosive atmospheres. Gas detectors. Performance requirements of open path detectors for flammable gases

BS EN 60079-30-1:2017
Explosive atmospheres. Electrical resistance trace heating. General and testing requirements

BS EN 60079-30-2:2017
Explosive atmospheres. Part 30-2 Electric resistance trace heating. Application guide for design, installation and maintenance

BS EN 60079-31:2014
Explosive atmospheres. Equipment dust ignition protection by enclosure "t"

BS EN 60079-32-2:2015
Explosive atmospheres. Electrostatics hazards. Tests

BS EN 60079-35-1:2011
Explosive atmospheres. Caplights for use in mines susceptible to firedamp. General requirements. Construction and testing in relation to the risk of explosion

BS EN 60079-35-2:2012
Explosive atmospheres. Caplights for use in mines susceptible to firedamp. Performance and other safety-related matters

BS EN 60085:2008
Electrical insulation. Thermal evaluation and designation

BS EN 60947-4-1:2010+A1:2012
Low-voltage switchgear and controlgear. Part 4-1 Contactors and motor-starters. Electromechanical contactors and motor-starters

BS EN 62262:2002
Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)

BS EN 62626-1:2014
Low-voltage switchgear and controlgear enclosed equipment. Enclosed switch-disconnectors outside the scope of IEC 60947-3 to provide isolation during repair and maintenance work

BS EN ISO 12100:2010
Safety of machinery. General principles for design. Risk assessment and risk reduction